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ABSTRACT

This report presents existing workforce levels, training programs and career potentials and develops staffing level projections (1976-1982) based on available information for the State of Wisconsin. The study concerns itself with the environmental pollution control areas of air, noise, potable water, pesticides, radiation, solid waste, wastewater, and energy. The format includes workforce profiles, projections, growth and career options for each of the areas investigated. Additional sections of the report outline state legislation and selected post secondary institutions with formal Environmental/Energy programs. A state profile and summary is included for cross-reference. The selected bibliography is appended in the Region V report. This document is one in a series of 69 which presents information for each of the states, Washington, D.C., Puerto Rico, and the Virgin Islands, and national and regional summaries. (CS)

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A National Environmental/Energy Workforce Assessment

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SE 023 343

NATIONAL ENVIRONMENTAL/ENERGY

WORKFORCE ASSESSMENT

for

WISCONSIN

Conducted by:

NATIONAL FIELD RESEARCH CENTER, INC

Under Grant from:

UNITED STATES

ENVIRONMENTAL PROTECTION AGENCY

Grant #T900591010

1977

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PREFACE

This study presents an analysis of existing workforce levels, training programs, and career potentials and develops five-year staffing level projections (1976 to 1982) based on available information for the State of Wisconsin in the environmental pollution control areas of air, noise, pesticides, potable water, radiation, solid waste, wastewater, and energy. This report is one portion of a study of the fifty states, Puerto Rico, and the Virgin Islands that was conducted by National Field Research Center, Inc., of Iowa City, Iowa.

The data presented in this report was compiled through comprehensive on-site interviews with professionals working in the public and private sectors. Supplementing this method were telephone surveys, mail contact, program plans, and research of relevant literature. It should be pointed out that the data, where not documented by records, represents the best professional judgment of these experts.

FOREWORD

Information for this report was largely compiled from on-site interviews with professionals within Wisconsin's state agencies with environmental protection functions and with professionals engaged in pollution control activities in the private sector. To strive for a higher degree of reliability, interviews were supplemented with telephone research. It should be noted that a large portion of the information contained herein represents the best professional judgments of those persons surveyed. The term "sources in the field" is used in this report to denote the pollution control professionals who provided information for the project. In cases in which more than one person provided input into a single program area, compilation of figures and recommendations was provided by the author. Much of the background material on agency programs, functions, and activities was obtained from program plans of the appropriate agencies.

This report provides information on the following eight pollution control fields: air, noise, pesticides, potable water, radiation, solid waste, and waste water, and energy. In Section C of each chapter entitled, Workforce Projections, average per annum growth/decline rates are derived by first calculating each year's growth rate for each category. The sum of these figures under each category is then found and is divided by the total number of years, i.e., by five.

Within the agencies and industries that were researched, compartmentalization of employees into the eight pollution control areas is not

necessarily a clearcut situation. Functions occasionally overlap, inter-divisional cooperation occurs, and certain components serve a supporting role to an entire agency. Efforts were made in the preparation of this report to provide sufficient information for the reader to have an understanding of those segments of the work-force that play a major role in environmental protection activities and to provide divisions in a logical, realistic, and understandable manner.

National Environmental Energy
Workforce Assessment

Phase I

WISCONSIN

State Summary

I. AIR

On the state level, air pollution control activities are handled by the Wisconsin Department of Natural Resources, Division of Environmental Standards, Bureau of Air and Solid Waste Management, Air Management Section. The Section has a permanent professional staff of 57 persons, with nine additional temporary posttions funded through Title X monies. During the next five years six positions will be added to the professional staff; however, this does not represent real staff growth, but rather it is conversion of six Title X employees to permanent staff status. The local air pollution control programs are staffed with a total of ten professionals. No growth is expected in the local agencies during the next five years.

Sources estimate that there may be up to 200 professionals working in air pollution control in industry. Professions include engineers, chemists, meteorologists, and computer specialists. Field research further suggests that there may be a technical workforce of approximately 250, most of whom do not devote full time to air pollution control. Growth in the private sector during the next five years will be quite limited. Some growth will occur as new plants are built and as air pollution standards become more stringent. Sources suggest that growth in the professional positions will be approximately 5% per annum, and that the technical workforce will increase by about 10% annually. There are an estimated 30 consultants in the state, and a growth of 5% per annum is predicted for the next five years.

II. NOISE

The Wisconsin Department of Transportation appears to be the most active state agency in environmental noise control and abatement. Within the Department, two divisions, the Division of Aeronautics and the Division of Highways, are involved in noise control. The Division of Highways has a professional staff of five; one civil engineer has full-time responsibility for noise control. The Division of Aeronautics employes three environmental engineers who devote part of their time to research and planning for airport noise control. The Division of Aeronautics expects staff growth during the next five years; however, the extent of staff expansion cannot, at present, be accurately determined. No growth is predicted in the staff of the Division of Highways.

The Wisconsin Department of Health and Social Services, Bureau of Environmental Health, Occupational Health Section administers the industrial noise control program for OSHA. The eleven member staff allocates a small fraction of its time to monitoring and enforcement of industrial noise control regulations. Limited growth is expected in this program over the next five years.

There appears to be a small workforce employed to control industrial and environmental noise within the private sector. These persons are often industrial hygienists for whom noise control is frequently an adjunct to other industrial health activities. No specific statistics are available on this segment of the workforce.

III. PESTICIDES

The Wisconsin Department of Agriculture, Plant Industry Division, Bureau of Special Services is the primary organization responsible for enforcing regulations concerning pesticide usage. The Bureau has a professional staff of twelve; approximately five person-years of effort per year are devoted to the pesticide program. This support is provided by eight agricultural scientists, an entomologist, and a biologist. Over the next five years, sources anticipate limited growth in the Bureau's program staff. Two agricultural scientists may be added to its field inspection staff during 1977.

Other state agencies involved in pesticide usage and control include the Department of Health and Social Services, the Department of Natural Resources, the University of Wisconsin Extension, and the Laboratory of Hygiene. An estimated 172 professional staff members of these agencies have pesticide related functions: No staff growth is expected in any of these programs during the next five years.

The pesticide-related private sector workforce consists of an estimated 4,500 commercial applicators and 112,000 farmers. Sources indicate that up to 80,000 private applicators, e.g., farmers, may require certification to achieve compliance with federal and proposed state legislative requirements. Specific workforce projections for the private sector cannot be made with sufficient accuracy.

IV. POTABLE WATER

The Wisconsin water supply activities are administered by the Wisconsin Department of Natural Resources, Bureau of Water Quality, Public Water Supply Section and Private Water Supply Section. The Water Supply Program is currently staffed by 20 full-time professionals and 19 temporary positions funded through Title X monies. The permanent staff of the program is expected to increase to 27 by 1977 and stabilize thereafter. Four of the positions represent a conversion of Title X workers to permanent staff members. The remaining Title X positions will most likely be eliminated after 1977.

The Wisconsin Laboratory of Hygiene, Environmental Science Section and Water Chemistry Unit employ 18 professionals whose functions include water supply activities. No growth is expected in the Laboratory's water supply program during the next five years.

Field research suggests that there may be up to 2,000 professional, technical, and labor personnel employed in the municipal water supplies. To the 2,000 persons, approximately 1,445 are certified treatment plant and water distribution system operators. Sources estimate that the number of operators will grow by approximately 8% annually during the next five years. While there may be some growth in the supportive staff in the municipal systems, no estimates of the extent of the increase are currently available.

V. RADIATION

Principal responsibility for radiation protection is vested in the Wisconsin Department of Health and Social Services, Bureau of Environmental Health, Radiation Protection Section. The Section has a professional staff of five persons: 1 administrator, 1 physicist, 1 chemist, and 2 technicians. Over the next five years, the Section anticipates adding three positions to its staff: one radiation consultant, one health physicist, and one laboratory technician or chemist. The addition of these three positions will be precipitated by the construction of two additional nuclear power plants.

The State Laboratory of Hygiene has a Radiation Protection Unit staffed by one chemist. The Laboratory of Hygiene may add one or two chemists when the nuclear power plants begin operation.

Limited information is available on the radiation-related private sector workforce. There are 87 facilities using industrial X-ray devices; each facility is required to employ a safety officer. The safety officer most generally has a background in industrial hygiene. There are 1,007 hospitals and 300 clinics using medical diagnostic machines. Many of these facilities employ a person who is charged with the responsibility of care and supervison of equipment. Little growth is anticipated in the workforce involved with industrial use of X-ray equipment. However, some growth is predicted in the private sector workforce as the nuclear power plants become operational.

VI. SOLID WASTE

The Wisconsin Solid Waste Management Program is administered by the Wisconsin Department of Natural Resources, Bureau of Air Pollution Control and Solid Waste Management, Solid Waste Management Section. A total of 24 permanent professional staff members are employed at the central headquarters and five district offices. The Section also employs ten Title X personnel. The Section estimates an average annual increase in staff of approximately 7%; however, most growth will result from the conversion of Title X employees to permanent staff positions.

The Wisconsin Solid Waste Recycling Authority has an authorized professional and clerical staff of forty; however, to date, only five of the positions have been filled. The Authority will be hiring approximately 35 more professionals over the next five years.

The private sector solid waste collection and disposal workforce currently has an estimated staffing level of 4,710 persons, with approximately 4,000 in the collection field and 710 in the disposal programs. During the next five years, growth is projected for the collection system workforce. The 2% growth in the workforce employed in collection will result from the increase in the volume of solid waste generated. Employment in disposal is expected to remain fairly constant.

A resource recovery facility, located in Milwaukee, will employ up to 68 persons, and a second facility scheduled for operation in 1979 will employ an estimated 30 persons.

VII. WASTE WATER

The Wisconsin Department of Natural Resources, Bureau of Water Quality has regulatory responsibility for the state waste water pollution control program. The current permanent professional and technical staffing level of the central and six district offices is 148. In addition, there are 22 temporary Title X employees who provide support to the program. Approximately 10 professional positions will be added to the permanent staff during the next five years; however, the growth represents a conversion of 10 Title X employees to permanent staff status. Ten of the Title X employees will probably be dropped after 1977.

Eighteen professionals employed through the Wisconsin Laboratory of Hygiene provide support to the waste water pollution control program. No growth is expected in the Laboratory's waste water program during the next five years.

Field research indicates that approximately 3,000 persons are employed in waste water treatment operations in Wisconsin. Of the 3,000 persons, an estimated 1,849 are municipal treatment plant operators and 110 are industrial treatment plant operators. The remaining persons include administrative, maintenance, and laborer personnel. Growth is expected in the demand for certified plant operators; specifically, from 850 to 1,000 new operators may be certified during the next five years. The demand for certified operators for industrial systems may also increase.

VIII. ENERGY

The Energy Section of the Office of State Planning and Energy is the principal state energy agency. The Section has a professional staff of six members: two with backgrounds in management, one physicist, one systems analyst, one computer programmer, and one petroleum allocation specialist. The Section anticipates hiring an engineer during 1977; however, following this staff addition, the staffing of the program is expected to stabilize for the next five years.

Limited information is currently available on the private sector energy related workforce. The electric utilities generally employ from one to two engineers whose functions include developing energy conservation programs. The utilities may also employ several non-degreed persons who, among their other responsibilities, conduct energy audits for homes and businesses.

State legislation which would require the electric utilities to establish energy conservation programs is now being considered by the Wisconsin State Legislature. If adopted, growth in the conservation staff within the electric utilities is anticipated. In addition, growth is also expected in the demand for solar engineers. Career opportunities are expected to grow for highly trained scientists and engineers in solar energy research. The demand for persons with training in the alternative energy sources field will continue to grow through the next ten years.

STATE OF WISCONSIN - SUMMARY

National Environmental/Energy Workforce Assessment
Pollution Control & Abatement Personnel
Projected Workforce Requirements (1976-1981)

Environmental Area	1976	1977	1978	1979	1980	1981	%/annum growth (average)
AIR	556	599	640	683	730	781	7%
NOISE[1]	19	19	19	19	19	19	n/a
PESTICIDES[2]	184	186	186	186	186	186	n/a
POTABLE WATER	2,057	2,199	2,323	2,463	2,603	2,743	6%
RADIATION[3]	6	6	7	7	11	11	n/a
SOLID WASTE	4,749	4,904	4,989	5,104	5,179	5,257	2%
WASTEWATER	3,147	3,317	3,477	3,647	3,817	3,987	5%
ENERGY[4]	6	7	7	7	7	7	n/a
TOTALS	10,724	11,237	11,648	12,116	12,552	12,991	4%

[1] Some growth is anticipated in state noise programs; however the extent of the increase cannot be accurately determined. No data is currently available on noise programs within the private sector.

[2] The above estimate includes only the state agencies' workforce projections. There are an estimated 4,500 commercial applicators and 112,000 farmers in the private sector utilizing pesticides.

[3] Limited information is available on the private sector; consequently, private sector projections are not incorporated into the above estimate.

[4] No information is currently available on the private sector energy-related workforce.

EDUCATION

Diverse environmentally-related curricula are available through Wisconsin's colleges and universities. Numerous community colleges and vocational technical schools offer training in environmental disciplines. Among the colleges offering associate degrees are: Milwaukee Area Technical College, Environmental Health Technology; Southwest Wisconsin Vocational-Technical Institute, Municipal Engineering; Moraine Park Technical Institute, Water and Wastewater Technology; and Austin Community College, Environmental Technology.

The various campuses of the University of Wisconsin offer environmental options in engineering and science programs. The University of Wisconsin, located at Madison, awards Master's degrees in Civil and Environmental Engineering with three environmental options: Structural Engineering, Water Resources Engineering, and General Civil and Environmental Engineering. Within these programs, courses are available in solid waste, potable water, wastewater, air pollution, and structural techniques used in environmental pollution control and abatement. The University also offers a Master's in Water Resources Management and a Master's and Doctoral program in Water Chemistry.

Another example of an excellent environmental education program is the environmental options available through Northland College. The College provides an environmental emphasis option in nearly every program area.

LEGISLATION

The environmental/energy legislation for Wisconsin was obtained by request from various agency personnel and through various library references. Summaries of the legislation deemed most relevant to the eight subject areas of the workforce assessment were prepared, and are included in the respective state reports. The following list of laws represents virtually all environmental legislation for the state. Only certain of the following laws were summarized; the list is presented to show, by title, the kinds of laws which have been enacted.

Governmental Environmental Impact Statements Law

Water, Ice, Sewage and Refuse Law

Wisconsin Pesticide Law

Pure Drinking Water Law

Radiation Protection Act

Solid Waste Recycling Authority Act

Solid Waste Systems for Localities Law

Pollution Discharge Elimination Law

Hazardous Substances Law

Inland Lake Rehabilitation Act

Mine Reclamation Law

Power Plant Siting Law

National Environmental Energy
Workforce Assessment

Phase I

WISCONSIN

State Report

STATE PROFILE

Ranked 16th in population and 25th in size, Wisconsin has a diversified geography and economy. Wisconsin's boundaries are formed by Iowa, Minnesota, Illinois, Lake Superior, and Michigan, and the state may generally be divided into three areas of economic concentration and geographical characteristics.

The majority of industrial and manufacturing capability found in Wisconsin lies in the southeast portion of the state. A heavily populated and industrialized area extending across the Illinois/Wisconsin state lines from Chicago north to Milwaukee makes Wisconsin the 12th largest manufacturing state in the Union.

Across the southern two-thirds of the state livestock, dairy, and related agricultural production dominate the economy, providing 85% of farm income. Though comprising the majority of Wisconsin's land area, this agricultrual region contains only 30% of the state's 4,539,000 population.

The northern portion of Wisconsin is a relatively sparsely settled, heavily forested area deriving its income from lumber and pulp production, tourism, hunting and fishing. It has one of the highest concentration of lakes in the world and provides a "north woods" climate well suited for trapping, fishing, and winter recreation.

WISCONSIN POLLUTION CONTROL AND ABATEMENT AGENCIES

The principal environmental agency in Wisconsin is the Department of Natural Resources. The Department of Natural Resources is the state lead agency for air, potable water, solid waste, and wastewater management programs. The Department of Agriculture is the state lead agency for pesticide use and control, and responsibility for the radiation program is vested in the Department of Health and Social Services. The Office of State Planning and Energy is responsible for the development of the state's energy policy.

The Department of Natural Resources, Division of Environmental Standards, plans, supervises, and coordinates the development of water quality standards, water supply, air pollution control, and solid waste management programs. The Bureau of Water Quality develops the water quality standards, plans and conducts monitoring and survey activities, and is responsible for the review of the planning, design, construction, and operation of public and private water supply systems, sewage treatment and industrial waste systems. Air quality control and solid waste management standards are developed and administered by the Bureau of Air and Solid Waste Management. Over 300 professional and technical positions compose the staffs of these programs. An additional 94 persons are employed on a temporary basis with funds provided through Title X of the Public Works and Economic Development Act.

The structure of the Department of Agriculture is built around seven units, with the Plant Industry Division, Bureau of Special Services

responsible for the pesticide program. Working through headquarters in Madison and 8 district offices, the Bureau staff of 12 agricultural scientists conducts the pesticide label registration program and inspects pesticide labels and commercial applicators.

The Bureau of Environmental Health, Radiation Protection Section in the Department of Health and Social Services administers the radiation protection program. The Radiation Protection Section has a professional staff of seven to carry out registration, inspection and monitoring activities.

The Office of Emergency Energy merged with the Office of State Planning in September, 1976 to form the Office of State Planning and Energy. The Energy Section of this office is made up of six professional staff members who are responsible for developing an energy data base for Wisconsin, encouraging energy conservation, and energy policy planning.

Pollution Control and Abatement Programs

I. AIR

A. Introduction

Particulate air pollution has been a problem in Wisconsin for many years, especially in the heavily industrialized and highly populated cities in the southeast portion of the state. Industrial sources of air pollution include food processing, lumber and woodworking, electric utilities, paper and allied products, asphalt mixing, secondary metals, and general manufacturing. Other sources of air pollution are automobile emissions and city and county institutional fuel combustion and incinerators.

One of the first county-wide air pollution control programs in the country was organized in Milwaukee County in 1948. It had a staff of 27 before ceasing operation in 1975 when the Wisconsin Department of Natural Resources assumed total responsibility for the county. The statewide air program was started in 1968 with responsibility for it given to the Department of Resource Development and its successor, the Department of Natural Resources.

In recent years air quality in Wisconsin has shown marked improvement. While suspended particulates were the most severe statewide air pollution problem in the early 1970s, currently, only one generalized problem area remains in downtown Milwaukee, with small problem areas in Racine, Kenosha, Beloit, Marshfield, and Superior. The problem in Milwaukee is being studied, and additional rules and enforcement will be forthcoming. Exacerbating the difficulty of achieving and maintaining particulate air standards is fugitive dust and miscellaneous small

sources. In urban areas the shortage of gas and oil which necessitates burning coal is likely to cause future problems with particulate levels and perhaps with SO_2 levels. Dry windy weather has caused general state and regionwide particulate problems.

Ozone is a statewide problem which occurs sporadically in the summer with hot hazy weather and south winds. While it is a widespread belief that high ozone levels occur primarily in urban areas, Wisconsin studies have shown that they are a problem in rural areas, as well, and extend as far north as the Michigan border. Since the problem of ozone is regarded as regional in scope, the state is planning for its control in cooperation with Illinois and Indiana. It is expected that this tri-state approach to solving the problem will be difficult and time consuming.

Carbon dioxide can be a problem in the traffic congested areas. No problems are known at present. Odors caused by packing, rendering, sewage treatment plants, and pulp mills present a further difficulty for the state. Toxic substances appear to pose little hazard. Surveillance of potential problem sources continues. Ambient asbestos levels appear very low as better laboratory techniques are needed to further define their levels.

B. Workforce Profile

Data for the workforce profile were obtained through on-site and telephone interviews with professionals in the field. The director of the Bureau of Air and Solid Waste Management and the chief of the Air Management Section Wisconsin Department of Natural Resources (WDNR) provided valuable assistance in the collection of these data.

On the state level, air pollution control program is under the Wisconsin Department of Natural Resources (WDNR), Division of Environmental Standards, Bureau of Air and Solid Waste Management, Air Management Section. The Air Pollution Control Council, a seven member council appointed by the Governor, serves the Department in an advisory capacity on air pollution and solid waste control matters. WDNR is the designated state agency to enforce the U.S. Clean Air Act. The state program includes U.S. EPA requirements.

The overall objective of the statewide air management program is to protect health, property, and general welfare, improve air quality, and preserve the air environment from degradation. The principal tasks for the Air Management Section for the 1977-1979 biennium are as follows:

1) Inspection and surveillance of the 848 point sources which emit ten or more tons per year of any five criteria pollutants.

2) Responding to and investigating complaints.

3) Statewide air quality monitoring through the operation of 103 manual (24-hour) instruments and 32 continuous instruments and collection of aerometric data. In addition the Section operates three mobile vans for statewide monitoring of large sources such as power plants, papermills, refineries, foundaries, and carbon monoxide levels from traffic.

4) New source review to determine if new sources meet specified emission limits, effect on air standards, and effect on air quality in "clean" locations.

5) Air quality planning for the eight EPA designated air regions.

6) Implementation plan revision with current emphasis on re-analysis by dispersion modeling to see if the present plan is adequate and forecasts of future air quality caused by projected growth.

7) Evaluation of all areas of the state currently cleaner than air quality deterioration that will be allowed, hold public hearings to clarify each area, and analyze proposed new air pollution sources to determine whether they can be built in a given area.

8) Responding to air quality episodes.

The operations of the Air Management Section are carried out through the central office in Madison and six district field offices located throughout the state.

The Air Management Section central office organization is divided into three units: Air Monitoring, Air Impact Analysis and Planning, and Engineering and Surveillance. The professional and technical staff of the central office totals 23. The Southeast District Office, which is responsible for the heavily industrialized area surrounding Milwaukee, is also divided into three units: Engineering and Surveillance, Enforcement and Plan Review, and Air Monitoring. This office has a professional and technical staff of 30 involved in air management. The other district offices, Southern, Lake Michigan, North Central, Northwest, and West Central, have a total professional and technical staff of 13 devoted to air pollution control activities.

The Air Management Section is composed primarily of environmental engineers, air pollution engineers, engineering technicians and inspectors, chemists, and instrument and electronic technicians. The distribution of personnel among these positions is shown in the following table.

TABLE I

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Air Management Section
Current (1976) Staffing Level

Position	1976
Engineer	25
Attorney	1
Meteorologist	1
Scientist	10
Technician	17
Other	3
TOTAL	57

In addition to the permanent staff depicted above, nine temporary positions are funded with Title X monies. These are field office positions and include three engineers, two chemists, three engineering technicians, and one management information specialist. In total, then, there are 66 professional and technical staff members in the Air Management Section.

The engineers hold positions designated either as environmental or air pollution control engineers. All are degreed and many are registered professional engineers. Training includes environmental, chemical, civil, mechanical, and industrial engineering. The scientists are predominantly degreed chemists, and some technicians have backgrounds in electronics and mechanics while others hold bachelor's degrees in a natural science. The "other" category includes the Section chief, who is a chemical engineer, a management information specialist, and an Air Management Unit supervisor, who is a meteorologist.

Eight authorized positions are vacant. Vacancies are for the following positions: supervisor, work coordinator, air pollution specialist, air pollution engineer, chemist, engineering technician, electronics technician, and laboratory technician.

The engineers inspect plants, measure stack emissions, check smoke density, answer complaints, acquire emission data, analyze the impact of existing sources, review environmental impact reports, and write impact statements. The chemists and related technicians monitor ambient air, operate three mobile vans, and collect, verify, and analyze air quality data. Technicians also maintain, repair, and calibrate the instruments.

The only district that does a considerable amount of continuous monitoring is the Southeast District, which contains the Milwaukee metropolitan area, and is heavily industrialized and populated. This monitoring is done by Air Monitoring Unit personnel. Air monitoring throughout the rest of the state is done largely by university and local government cooperators, who are furnished with monitoring equipment and paid for their services. This method is less costly than stationing WDNR personnel throughout the state, and it provides the opportunity for students to learn the use of the equipment.

The WDNR Laboratory and the Wisconsin Laboratory of Hygiene provides laboratory support to the Air Management Unit. The Air Chemistry Unit employs three chemists, two laboratory technicians, and one electronics technician.

Three local air pollution programs are currently in operation in Wisconsin. The Racine County program has a full-time staff of

two, a director and an inspector-technician, and operates in cooperation with WDNR. Eau Claire and Douglas Counties also have small local programs and cooperate with WDNR. County and other local programs are expected to enforce non-point source problems and nuisances such as leaf burning and small incinerators, while WDNR enforces emission limits on point source and air standards through out the state.

Thus, approximately 76 professional and technical personnel work in the state air management program.

To obtain information concerning the workforce involved in air pollution control activities in the private sector, estimates were solicited from WDNR personnel involved in the air management program and from selected private sector sources engaged in air pollution control programs. It should be noted that estimates represent the best professional judgment of sources in the field.

Public and private sector sources estimate that there may be up to 200 professionals working in air pollution control in industry. The majority of this workforce is employed by the electric utilities, papermills, foundries, and refineries. Professions include engineers (primarily chemical and mechanical), chemists, meteorologists, and computer specialists. Activities are carried out both by corporate environmental staffs, if corporate headquarters are located in Wisconsin, and by plant engineering departments. Corporate environmental staffs are responsible for environmental policy planning, long-range planning of facilities and equipment, conducting environmental studies, preparing environmental reports for regulatory agencies, keeping

top management informed of new rules and regulations, auditing plant performance as it relates to air pollution control, and providing technical assistance to plants in solving air pollution problems. Engineering departments are responsible for ensuring plant compliance with air pollution control regulations, air quality monitoring, and operation and maintenance of air pollution control equipment. These departments also are responsible for interior plant conditions, such as control of fumes and chemicals, in accordance with OSHA regulations, as well as for control of outside air pollution caused by plant operations.

Assisting with these activities are nondegreed technical personnel. Field research suggests that there may be a technical workforce of approximately 250. Most of the professional and technical workforce does not devote full time to air pollution control. Rather, these personnel may be involved in other environmental control activities, and frequently, they perform other functions that are not related to environmental matters. If it is assumed that this workforce devotes 25% of its time to air pollution control, a person-year approximation of the time devoted to air pollution control in a year is 110, 50 person-years of which is professional and 60 technical.

Professionals in the field indicate that it is often more cost-effective for a company to hire outside consultants to solve a particular problem than for it to augment its permanent staff. Sources in the field estimate that there are approximately 30 air pollution consultants in Wisconsin with credentials in engineering, chemistry,

and meteorology. Many corporations utilize the services of out-of-state consultants.

In filling professional positions in industry, companies tend to seek persons with experience in pollution control who have a knowledge of environmental regulations and technology. Consequently, recruitment is often conducted through advertisements in newspapers and professional journals, it may occur from within the company, or positions may be filled with persons recruited from governmental agencies. For technical positions, recruitment is primarily from within the company because of union regulations which require that members receive first consideration for job openings. Technicians who have electrical, mechanical, or combustion background are favored.

In sum, it appears that there are approximately 550 professional and technical persons employed in the field of air quality control in the public and private sectors, with a person-year per year estimate of 200. Approximately one-third of the air pollution control effort is conducted in the public sector, primarily by the Air Quality Management Unit of WDNR and two-thirds of the effort occurs in the private sector, either through industry or by consultants.

C. Workforce Projections

Workforce projections regarding the Air Management Section are based on the best professional judgment of persons involved in the state air program.

For the 1977-1979 biennium, the Air Management Section is requesting 30 additional technical and professional positions. However,

because of insufficient state and federal funding, it is anticipated that only six of these positions will be authorized, and they will represent the conversion of six Title X employees to permanent staff status. After the 1977-1979 biennium, it is probable that there will be no further growth in the permanent state staff to 1982. Workforce projections for the Air Management Section are exhibited in the following table.

TABLE II

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Air Management Section
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	25	28	28	28	28	28	10%	2%
Attorney	1	1	1	1	1	1	n/a	0
Meteorologist	1	1	1	1	1	1	n/a	0
Scientist	10	10	10	10	10	10	10%	0
Technician	17	20	20	20	20	20	33%	4%
Other	3	3	3	3	3	3	n/a	0
TOTAL	57	63	63	63	63	63		2%

It should be noted once again that the increase of three engineers and three technicians does not represent real staff growth, but rather it is the conversion of six Title X employees to permanent staff status. The other three Title X positions will continue through 1977 although other sources of funding will be utilized. After 1977, the continued employment of these temporary persons is uncertain.

According to the Air Management Section, the continuing level of funding represents less than two-thirds of that which is needed to

hire sufficient staff to adequately carry out its workload. In addition, it is likely that three temporary positions will be lost after 1977 if funding for them ceases. Consequently, the program is expected to be carried out at an inadequate level with the following results:

1) Reduced inspection of point sources,
2) Performance of fewer stack tests,
3) Answering of fewer complaints,
4) Closing or curtailment of monitoring stations,
5) Less prompt and possibly less adequate review of new sources,
6) Late implementation plan revisions and AQMA plans, and
7) Possible nondetection of air quality episodes.

Turnover rates in the Air Quality Section are about 10% per year among the professional positions. Many engineers are hired upon graduation from college, and after several years of governmental experience are attracted to private sector jobs which tend to offer higher salaries. The turnover rate for technicians is significantly higher, approximately 33%. Some technicians are also lost to industry as a result of higher salaries there. Also contributing to the relatively high turnover rate for technicians is the fact that some are University of Wisconsin graduates who are science majors and overqualified for the technician positions. These graduates seek Civil Service jobs to remain in Madison but often leave when better opportunities become available elsewhere.

The Wisconsin Laboratory of Hygiene expects no staff growth in the Air Management Unit. The three local air pollution control programs in Racine, Eau Claire, and Douglas Counties also expect no staff growth over the next five years.

Workforce projections regarding the private sector were obtained through on-site and telephone interviews with public and private sector professionals engaged in air pollution control activities. These sources were asked to provide their best estimate of workforce projections for air pollution control.

Growth in the private sector air pollution control workforce is expected to surpass that of the public sector. Nevertheless, growth will be quite limited. Most companies developed their environmental staffs in the early 1970s and most are now in compliance with air pollution standards. In fact, only 12 of the 373 major installations are in violation of emission standards or compliance schedules. Thus, there is no reason to expect any surge in growth. However, some growth will occur as new plants are built and as air pollution standards become more stringent. Sources in the field project that the professional workforce engaged in air pollution control will increase at an approximate rate of 5% per year, with most new job openings expected to be primarily for engineers. Among the technical workforce, growth is expected to occur at an annual rate of approximately 10%.

It should be remembered that if a company is experiencing a compliance problem or requires short-term assistance, it will often

hire an outside consultant rather than increase its staff. Since out-of-state consultants are frequently utilized, sources in the field expect the growth for Wisconsin based consultants to occur at a rate of about 5% per year.

Specific turnover rates for the private sector are not available. Private sector sources, however, report that turnover is low for both professional and technical positions.

The following table illustrates estimated growth to 1982 for professional, technical, and consulting positions. Numbers represent person-year equivalents.

TABLE III

STATE OF WISCONSIN

Private Sector
Professional, Technical, and Consulting Positions
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	Growth/Decline Average
Professional	50	53	56	59	62	65	5%
Technical	60	66	73	80	88	97	10%
Consultant	30	32	34	36	38	40	5%
TOTAL	140	151	163	175	188	202	8%

Clearly, public and private sector growth in the air pollution control workforce will be small. Overall growth for the public sector is projected to be an annual average of 2%, with all of this growth being the result of the conversion of Title X employees to permanent staff positions. Overall per annum growth for the private sector over the next five years is expected to be 8%. However, it

should be noted that the numbers involved in the private sector are quite small, and the 8% growth rate represents an increase of approximately 60 person-years of effort over the next five years, not 60 jobs.

D. Training and Certification

The Air Management Section of WDNR utilizes five sources for staff training: EPA sponsored courses, courses sponsored by the lead air pollution control agencies of other states, internal technical seminars, seminars sponsored by technical associations, and the University of Wisconsin-Extension.

The Air Management Section attempts to utilize EPA sponsored training courses as extensively as possible, but because of travel restrictions no more than 20 to 25 staff members attend these courses each year. Since the Section does not provide smoke schools but does require certification of smoke readers, staff members are sent to EPA sponsored smoke schools or those of neighboring states every six months, if possible. Although the Section would like to purchase a smoke generator and provide smoke reading instruction, it has not been granted sufficient funds and personnel to do so.

The Air Management Section conducts quarterly technical and managerial seminars, with choice of topic dependent upon staff requirements. These seminars are one day in duration and open to both WDNR and industry personnel. Approximately 100 people attend these seminars each year. In addition, staff members of the Air Management Section attend relevant special meetings of technical associations,

such as those of the Technical Association of the Pulp and Paper Industry and the American Society of Testing Materials, as the travel budget will allow.

The University of Wisconsin-Extension also participates in training Air Management Section staff, other professionals in the air quality field, and the general public. In fiscal year 1975, UW-Extension devoted 7.5 staff days to air quality instruction providing 242 client contact hours either through its own staff in the Extension offices throughout the state, specialists on the main campuses, or through programs coordinated by Extension faculty. By November of fiscal year 1976, UW-Extension had devoted 4.5 staff days to air quality instruction and had provided 580 client contact hours.

The Milwaukee Area Technical College offers an environmental health technology curriculum, a two year program which leads to the degree of associate of applied science. Concentration is either in environmental health or water and wastewater technology. Approximately ten students graduate with the environmental health concentration, and most find jobs in local health departments where some aspects of their job may be related to air pollution control.

On the professional level, the University of Wisconsin trains a large number of the engineers and scientists working in air pollution control in the state. However, the university does not offer specialized air pollution control curricula.

E. Career Potential

From the available information, it appears that growth in professional and technical level employment in the air pollution control field will be limited. No real growth will occur in the public sector, even though a serious need exists for additional staff, and any staff additions are likely to be the conversion of Title X employees who are already working in the air program. In the private sector, 5% annual growth is expected for professional positions, in particular for engineers and also for chemists. The largest area of private sector growth will be for technical personnel. This workforce is expected to grow at a rate of 10% per annum. Private sector growth will occur as a result of economic development and more stringent legislation such as the possible passage of the Clean Air Amendments. If economic development progresses at a faster rate than anticipated, both the private sector professional and technical workforce effort could increase more than the projected 8% per annum average, and career opportunities would therefore improve.

Because career opportunities in air pollution control are limited, sources in the field advise that vocational/technical schools not establish programs designed specifically to train air pollution control technicians. However, they do recommend that vocational/technical schools provide sound training in the basic technical skills such as instrument use, measurement taking, calibration, and error identification. Such curricula allow graduates not only to

perform air pollution control activities competently and with a minimum of on-the-job training, but they also provide graduates with a technical background that can be applied to a variety of jobs.

F. Conclusion

The air pollution control field is staffed primarily by engineers, chemists, technicians, and meteorologists, with growth in the field and career opportunities quite restricted. There will be few, if any, workforce opportunities in the public sector because of inadequate funding, and the rate of growth for private sector opportunities is limited since most companies developed and adequately staffed their environmental component in the early 1970s.

There will be changes, however, in public sector activities. Specifically, more resources will be devoted to enforcement, planning, and nondeterioration, while the amount of air monitoring will be reduced. These changes are not expected to alter staffing patterns significantly. One area of expected controversy is nondeterioration. New revisions to the Clean Air Act are expected to require that each state evaluate all areas of the state now cleaner than air standards to determine how much deterioration will be allowed. Such determination is ultimately a land use issue since it determines whether or not a new air pollution source can be built

in a given area. Consequently, the subject will be controversial, and WDNR anticipates that it may require a major resource commitment.

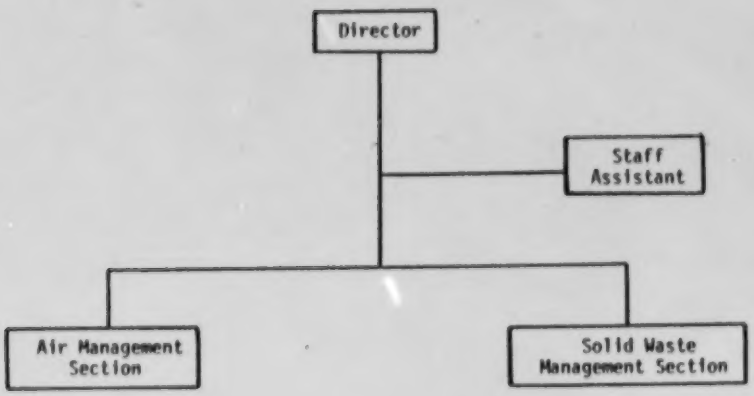
According to sources in both the state air program and in the private sector, it is not necessary for prospective employees to have specialized air pollution control training. Rather, at the degreed professional level a solid foundation in engineering or the physical sciences is recommended and at the technical level a good background in the use of instruments, taking measurements, and calibration is recommended. Additional training needs can be effectively met through on-the-job training, having staff members attend selected college courses, and through short courses, either EPA, vocational/technical institution, or university sponsored.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Division of Environmental Standards

Bureau of Air and Solid Waste Management

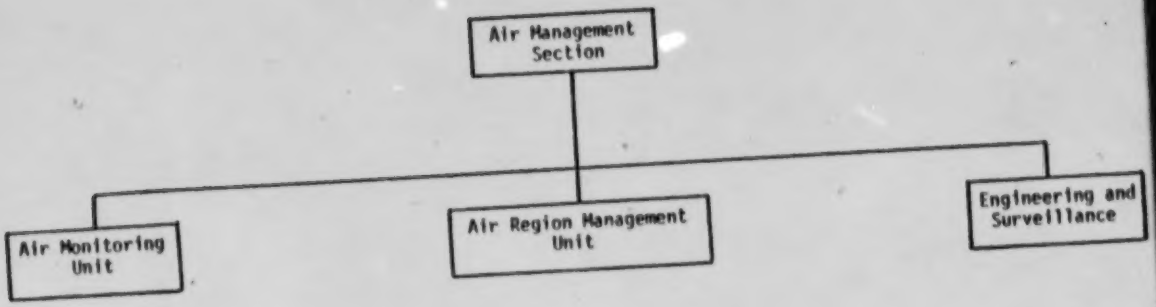
Figure 1.



WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Air Management Section

Figure 2

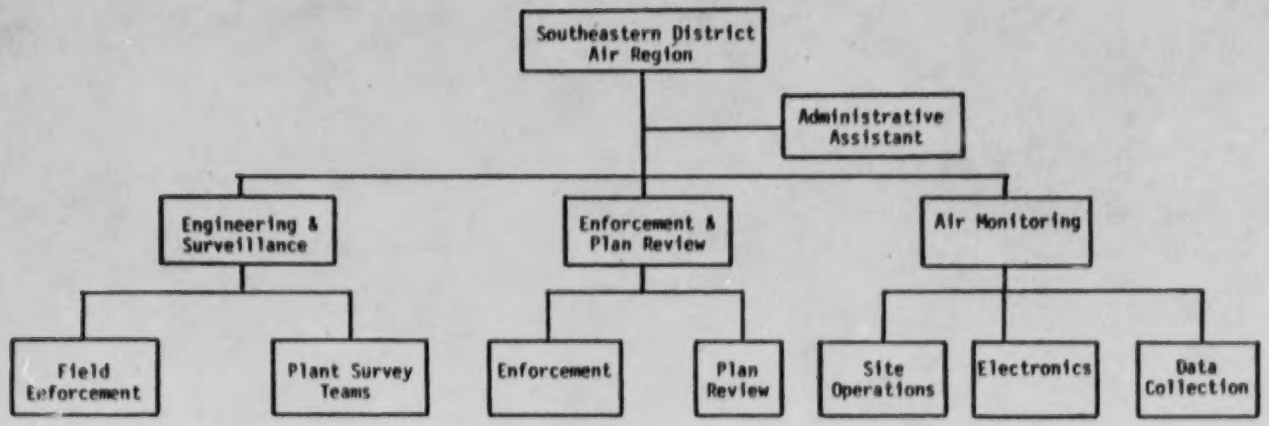


WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Southeast District Air Region

Air Management Section

Figure 3



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II. NOISE

A. Introduction

Wisconsin has no noise legislation at the state level, and activities in environmental noise control are quite limited. The Wisconsin Department of Transportation (WDOT) appears to be the most active state agency in terms of environmental noise control and abatement. WDOT has been proposing legislation for the past several years to control airport noise. This legislation focuses on land use zoning in the vicinity of airports. Because the Department's proposal restricts the zoning power of local communities, it has so far been rejected by the Wisconsin Legislature. However, state government sources indicate that the bill may be passed this year, albeit in a modified form with less effective results expected. WDOT is also involved in control of highway noise. Other work being done in noise abatement includes research conducted at the University of Wisconsin, the drafting of model legislation by the Upper Great Lakes Basin Commission for noise abatement for off-the-road vehicles, activities of municipalities through local noise ordinances, and occupational noise control by the Wisconsin Department of Health and Social Services and by industry.

B. Workforce Profile

Data for the workforce profile and workforce projection sections was obtained through on-site and telephone interviews with professionals in the field.

Two separate divisions of WDOT are involved in noise control and abatement, the Division of Aeronautics and the Division of Highways. The Division of Aeronautics employs three environmental engineers who devote part of their time to research and planning for airport noise control. The Division of Highways has an environmental section of five staff members. One is a civil engineer and has full-time responsibility for noise control and abatement. A noise report is required for any highway project that will increase noise levels either as a result of a change in facilities or an increase in traffic. Noise reports are also required for inclusion in environmental impact studies for other highway projects. The civil engineer is responsible for the development of noise guidelines, policy planning, research, and providing technical assistance to the nine district field offices. The district project engineers, who are highway engineers, are responsible for producing these reports. The amount of time devoted to the research necessary for the reports and for report writing is dependent upon the nature and complexity of the project.

Four cities in the state, Madison, Milwaukee, Racine, and Sparta, have municipal noise ordinances. The types of ordinances are shown below. This table is adapted from Sound and Vibration, December, 1975.

TABLE IV

STATE OF WISCONSIN

Municipal Noise Ordinances (1975)

City	Nuisance	Zoning	Vehicle	Rec/ Vehicle	Railroad	Aircraft	Construction	Building
Madison	X	X	O	-	-	-	-	-
Milwaukee	X	X	X	-	-	-	-	-
Racine	X	X	-	-	-	-	-	-
Sparta	O	-	O	-	-	-	-	-

KEY: X Regulations including acoustical criteria
O Regulations not including acoustical criteria
- No regulation

These ordinances are enforced by local law enforcement authorities. The omission of acoustical criteria leaves regulations nonquantitative and, therefore, difficult to enforce.

The industrial noise control program of OSHA is carried out by the Wisconsin Department of Health and Social Services, Bureau of Environmental Health, Occupational Health Section. The Occupational Health Section is staffed by five engineers, two occupational health nurses, and four chemists. This staff devotes a small fraction of its time to monitoring and enforcement of industrial noise control regulations. Also involved in control of industrial noise are persons within industry. These persons are often industrial hygienists for whom noise control is frequently an adjunct to other industrial health activities.

In sum, there appears to be a small workforce employed to control industrial and environmental noise. Many of these people are involved in noise control on a part-time basis.

C. Workforce Projections

Division of Aeronautics sources indicate that if airport noise control legislation is passed, their workload will increase considerably. The increased workload will include noise forecasting, conducting noise contour studies, and providing recommendations on types of land use. Consequently, additional engineers and planners may be hired; however, the extent of growth cannot be predicted at this time. Division sources expect that other departments such as the Wisconsin Department of Natural Resources would become involved in some of this work, as well as private consultants. At present, there appear to be few, if any, consultants with expertise in environmental noise control, but if the demand should develop, division sources are confident that existing consulting engineering firms would acquire the requisite expertise.

The Division of Highways expects no increase in the amount of time or staff devoted to noise control since past experience in this area has allowed them to develop a relevant data base and to become more efficient. Moreover, since funds for the depart are limited, few noise sensitive projects are being conducted. Should funding increase, the workload in this area could also be expected to increase.

The University of Wisconsin is conducting research in inudstiral and environmental noise control. However, the numbers of persons involved and workforce projections are not available.

Because environmental noise pollution control has not developed as a distinct professional area and because there is currently little interest in this field with the exception of control of airport noise, the workforce in this area is expected to grow slowly over the next five years.

D. Training and Certification

Courses in environmental noise technology are offered by the University of Wisconsin and the University of Wisconsin-Extension. In fiscal year 1976, 19 persons enrolled in the UW-Estension course which was designed specifically for engineers.

The Division of Highways conducts an annual engineering training program for the orientation of new employees. Several hours of the program are devoted to the subject of noise. The division has also held two conferences in the past four years in environmental noise control for its staff. Approximately 25 persons attended each conference. Since the subject is now considered well-defined and staff members competent to handle their duties, no further conferences of this type are expected to be held.

Occasional informational, general environmental, or industrial safety courses are held by community colleges, but these are not specifically concerned with noise pollution and do not lead to a degree or certification.

E. Career Potential

Since workforce growth in the area of noise pollution control is extremely limited, there is little evidence that a significant number of career opportunities will develop over the next five years. In addition, experts in the field indicate that they are aware of no new or unique careers emerging in this area. Environmental engineers and technicians employed both in industry and in the public sector may be assigned noise control duties. However, it is unlikely that distinct careers in noise control, other than equipment and building design, will be developing.

F. Conclusion

At the present time the noise pollution control field is staffed primarily by engineers and industrial hygienists, and there is some potential for planners to become involved in this area. There appears to be little potential for distinct noise-related career opportunities to develop in the near future, particularly on the nondegreed technical level. Proposed noise legislation on the state level is concerned with the control of airport noise, but its passage has been hindered by the vicissitudes of local zoning politics. Overall, the noise control field is expected to grow slowly over the next five years.

There is a definite lack of activity in environmental noise control in Wisconsin, with the exception of the WDOT. If public awareness or national policy forces the development of environmental noise control regulations, there will be a need for trained scientists, engineers, planners, systems analysts, attorneys, and administrators, as well as for technicians. If development in this field should occur, upgrade/enrichment programs will be necessary for involved personnel of all professions, and program development will be required, in particular for training in less than degreed technical areas where no training programs currently exist.

III. PESTICIDES

A. Introduction

The present Wisconsin pesticide legislation required the registration of labels of all pesticides which are distributed, sold, or transported for sale within the state. Legislation which would allow Wisconsin to comply with FIFRA and its amendments is currently in draft stages. Before going to the State Legislature, it has been submitted to EPA for a determination of whether it meets the minimum FIFRA requirements. Because there has not been mandatory certification of applicators to date in Wisconsin, data on the numbers of commercial applicators have not been collected at the state level. Moreover, private sector sources find it difficult to estimate statewide applicator and crew size figures. However, preliminary estimates of the number of commercial applicators are available and will be shown in this report. This information can be validated as the certification program progresses.

Sources in the field indicate that the imminence of a certification requirement for restricted use pesticides has significantly upgraded the practices of commercial applicators. Nevertheless, problems still remain and include improper application, overuse, drift, improper disposal of containers, and improper container storage.

Established in 1969, the Pesticide Review Board is responsible for the development of pesticide policy on the state level. Its membership consists of the secretaries of the Department of Agriculture, the Department of Health and Social Services, and the Department of Natural Resources. It recommends to the Department of Agriculture,

the state lead agency for pesticides, rules for the protection of persons and property from pesticide hazards. Rules concerning pesticides are not effective until they are approved by the board. If the proposed pesticide law is passed, the board will adopt standards for training and certifying private and commercial applicators. In adopting these standards, the board may establish separate categories or subcategories of pesticide use and application, depending on the specific types of pesticides used, the purposes for which they are used, types of equipment required in their application, the degree of skill and knowledge required, and other factors which may warrant creation of different categories.

Information and advice on pesticide policy issues are provided to the Pesticide Review Board by the Pesticide Advisory Council. This is a nine member board of pesticide experts. Membership represents the Department of Agriculture, Department of Health and Social Services, Department of Natural Resources, the pesticide industry, the agricultural industry, the University of Wisconsin, and environmental interests.

B. Workforce Profile

Workforce profile data was collected through on-site and telephone interviews with professionals in the field and in the public and private sectors. The Wisconsin Department of Agriculture, Plant Industry Division, Bureau of Special Services is the primary organization responsible for enforcing regulations concerning pesticide usage. The Plant Industry Division is responsible for the protection, control and

eradication of pests and diseases of plants. The Division administers enforcement programs for feed, fertilizers, seed, and pesticides. The Bureau of Special Services administers the annual pesticide label registration program. In addition, Bureau personnel inspect pesticide labels to ensure their accuracy and compliance with state regulations. They also inspect commercial applicators to check on pesticide use practices.

The Bureau of Special Services has a professional staff of twelve. Eight positions are in the field offices, and four are in the Madison headquarters. Approximately five person-years per year are devoted to the pesticide program, which is conducted by eight agricultural scientists, an entomologist, and a biologist.

University of Wisconsin-Extension personnel spend approximately fifteen person-years per year in the area of pesticides. This includes the work of county extension agents as well as specialists on the main campus. Their principal activities are training and advising in the use of pesticides, herbicides, fungicides, and other chemical pest control methods.

The Department of Natural Resources, Division of Environmental Standards and Division of Forestry, Wildlife and Recreation also is involved in pesticide pollution control. Eight professional staff members devote approximately four person-years per year to the control of toxic substances including monitoring pesticide application and investigating oversprays. These staff members are trained in biology, chemistry, and environmental engineering. In addition, 150 conservation wardens collect samples if an overspray occurs and monitor aerial

spraying as one part of their job. The conservation wardens are degreed and usually have law enforcement training.

Laboratory work in pesticides is conducted by the State Laboratory of Hygiene, Pesticide Chemistry Unit. This unit employs a staff of three: one chemist and two laboratory technicians. One sanitarian works part-time in vector control in the Department of Health and Social Services.

Sources in the Bureau of Special Services estimate that there are approximately 4,500 commercial applicators in the state and up to 80,000 private applicators who may need certification to achieve the requirements of federal and proposed state legislation.

The total estimated pest control picture is reflected by the following table in which figures are approximations of the workforce engaged in pesticides on either a full- or part-time basis.

TABLE V

STATE OF WISCONSIN

Public and Private Sector Pesticide Workforce
Current (1976) Staffing Level

Public Sector	1976
Department of Agriculture	12
Department of Health & Social Services	1
Department of Natural Resources	158
University of Wisconsin-Extension	10
Laboratory of Hygiene	3
TOTAL	184

Private Sector	
Farmers	112,000
Owners/Operators/Applicators	4,500
TOTAL	116,500

Although there are approximately 112,000 farmers in Wisconsin, it should be noted that an estimated 73,000 of them use pesticides. The Department of Agriculture expects to certify between 40,000 and 80,000 private applicators by 1978.

In sum, there are approximately 184 public sector professional and technical personnel involved in pesticide usage and pest control practices. Their activities include inspection, enforcement, training, advising, and laboratory analysis. In the private sector, approximately 116,500 persons are engaged in the application of restricted use pesticides, and Department of Agriculture sources estimate that between 44,500 and 84,500 will require certification as commercial and private applicators if the proposed state pesticide legislation is passed.

C. Workforce Projections

Information concerning workforce projections was collected through on-site and telephone interviews with state governmental personnel involved in pesticides and with private sector sources. Projections represent the best professional judgment of these sources. Especially helpful in the compilation of workforce projections were the Director of the Plant Industry Division, Bureau of Special Services, Department of Agriculture, and the Chief of the Surveillance Section, Bureau of Water Quality, Wisconsin Department of Natural Resources.

According to state government soruces, there will be little growth in employment in the public sector in pesticide usage and pest control activities with the exception of the Department of Agriculture. The

Department of Agriculture, Bureau of Special Services plans to add two agricultural scientists to its field inspection staff in 1977 if the proposed pesticide legislation is passed. These additions would represent only a one percent increase in employment in the public sector in the field of pesticides. Turnover in the public sector is low, approximately five percent per annum.

Sources in the field point out an interesting private trend. That is, the prospect of certification and more stringent legislation is causing some companies, particularly the smaller ones, to sell out to larger companies or to cease operation altogether. The turnover rate among commercial applicators is estimated to be between ten and fifteen percent per year. However, new companies tend to replace those that are no longer operational, and many smaller companies become absorbed by larger companies. Consequently, although there is significant activity in the private sector in terms of business starts and failures, this situation does not appear to have much effect on workforce projections.

Turnover rates for commercial applicators, certified and noncertified, are not available, but sources in the field indicate that turnover is not a problem. These sources suggest that persons frequently enter this field because they prefer the outdoor work and variety of tasks that the job affords. Pay rates for commercial applicators and crew range from four to ten dollars per hour (approximately [illegible]0 to $1,800 per month).

Sources in the field expect an increase in demand for commercial applicators over the next five years. This demand will result as increasing public awareness of the potential hazards of pesticides and

certification requirements for application of restricted use pesticides causes farmers and commercial establishments (buinesses, stores, restaurants) to enlist the services of commercial applicators, rather than to become certified and apply pesticides privately. Although this trend can be predicted with certainty, the magnitude of increase in the demand for commercial applicators and the resultant workforce implications cannot be determined at this time.

Overall workforce projections, then, indicate a minimal (one percent) increase in employment in the public sector, and a net increase in the private sector in pesticides, specific workforce projections cannot be made with sufficient accuracy.

D. Training and Certification

The most extensive training effort is conducted by the University of Wisconsin-Extension. The Extension is now responsible for most of the training leading to the certification of commercial and private applicators. Approximately 1,600 persons have attended Extension training sessions for applicator certification so far, three-fourths of whom are commercial applicators and one-fourth private. At this time certification is voluntary but will become mandatory if the proposed pesticide legislation is passed.

The University of Wisconsin-Extension has provided current statistics on the Extension's training and advising efforts in pesticides. The following information includes training for applicator certification as well as for other persons involved in pesticide usage. Staff in the offices throughout the state and specialists on the main campuses conduct the training and advising. To date in Fiscal Year 1976,

the Extension devoted a total of 2,401 staff days to pesticide, herbicide, fungicide, and other chemical pest control programs. The staff provided 51,879 client contact hours in a group setting, 9,675 client contact hours on a one-to-one basis, and 73,929 client contact hours through programs coordinated but not necessarily taught by Extension faculty.

The Wisconsin Pest Control Association, an association of structural applicators, works to keep its approximately 50 members informed of the status of various pesticides and cooperates with the University of Wisconsin-Extension in the conduct of workshops oriented toward applicator certification.

The Department of Agriculture, Plant Industry Division, holds quarterly training sessions for all division employees. Education in pesticides is one facet of this training which is conducted by Department personnel, as well as by instructors from EPA and OSHA. The Department of Natural Resources provides the 150 conservation wardens with yearly training on the monitoring of aerial pesticide application and collection of evidence on overspraying.

Department of Agriculture sources point out that new entrants to the state agency do not have sufficient understanding of the regulatory process. They suggest that the universities should provide some training in regulation and enforcement. Moreover, they point out that there is a need for training in integrated pest management.

A final training need is for the public. Many people are not aware of the laws regulating pesticide usage, often apply old pesticides, and do not follow the directions on the label. Consequently, sources suggest that the public be provided with educational pesticides.

E. Career Potential

Opportunities in the commercial applicator field will be expanding although, as pointed out above, the future magnitude of this increase cannot be ascertained at the present time. Sources in the field indicate that within this area, sanitarians are assuming increasing importance as a result of more stringent pesticide regulations. Sanitarians usually require a degree in science and act in such capacities as consumer safety officers and inspectors. Field research suggests that integrated pest management will be increasingly utilized, thus providing career opportunities both for degreed scientists and for technicians. Again, there is not enough data available to predict the magnitude of demand for persons with training in integrated pest management over the next five years. At the present time, however, there is little training being done in integrated pest management either at the university or vocational/technical level. If the demand for trained personnel in this area does begin to show significant strength, it will be necessary for educational programs to be designed to provide both professional and technical training. Research is being conducted in integrated pest management at the University of Wisconsin.

Additional research in various aspects of pesticides is necessary for their efficacious and safe use. Subjects for investigation include the acceptable use of particular pesticides, environmental effects of pesticides, container disposal, and integrated pest management. This research requires advanced scientific training. Career opportunities in this area will be contingent upon the amount of funding available.

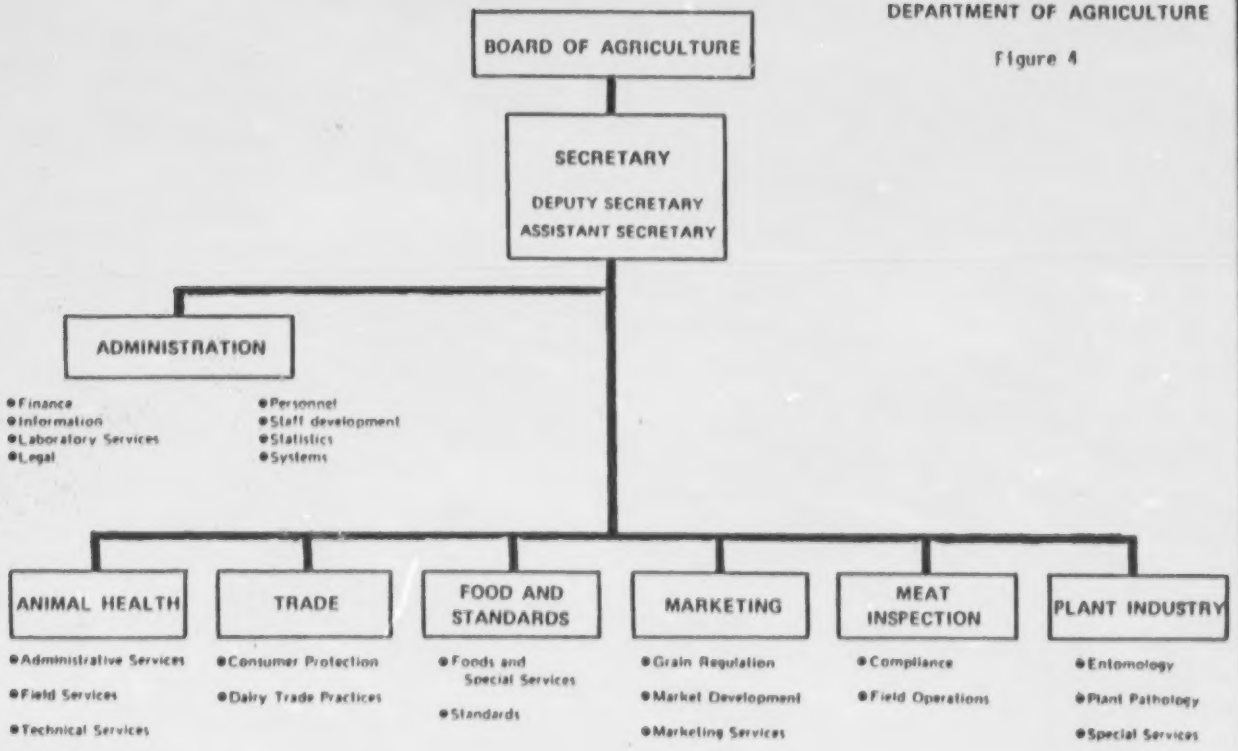
F. Conclusion

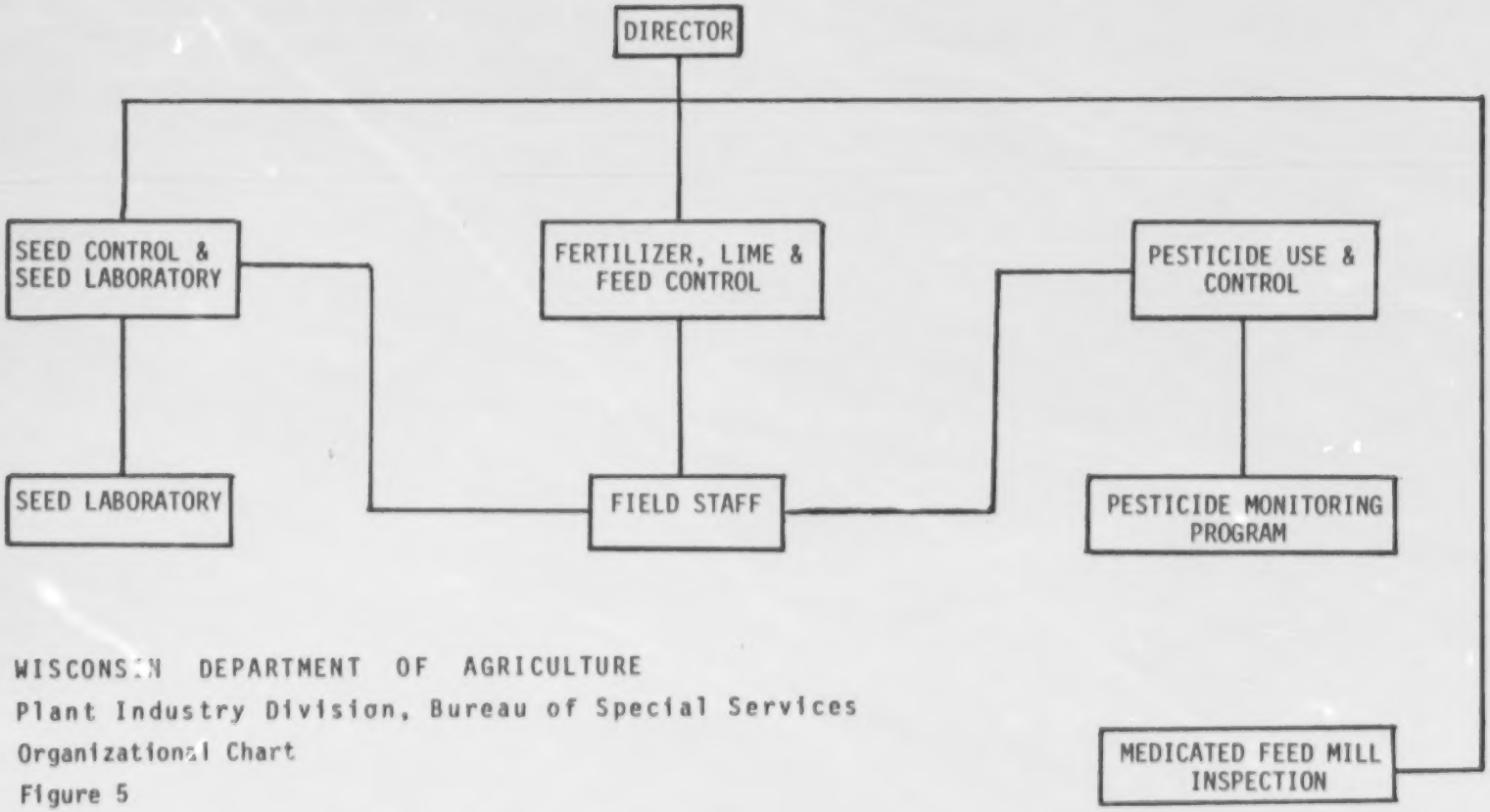
While employment opportunities in the public sector are limited, some growth can be expected among commercial applicators. However, information concerning projected workforce needs for commercial applicators is difficult to collect since the exigencies of competition make companies engaged in this business reluctant to reveal workforce information. If the proposed state pesticide legislation is passed, certification activity will increase for commercial and private applicators. Responsibility for such training will be assumed by the University of Wisconsin-Extension, which already is involved in pesticide training.

Although integrated pest management is in a relatively early state of development, the use of these techniques is likely to become more widespread as federal and state regulations become more stringent and as additional research becomes available. Consequently, the demand for trained personnel can be expected to develop, and both universities and vocational/technical institutions may find a market for graduates trained in integrated pest management. It should be noted that this market may not develop for several years.

WISCONSIN
DEPARTMENT OF AGRICULTURE

Figure 4





WISCONSIN DEPARTMENT OF AGRICULTURE
Plant Industry Division, Bureau of Special Services
Organizational Chart
Figure 5

IV. POTABLE WATER

A. Introduction

There are 680 municipal water supplies in Wisconsin. These plants and operator certification are divided into four classifications based on the types of treatment: M-1) Groundwater without treatment; P-1) Iron removal and zeolite softening; G-1) Lime softening; and, S-1) Surface water treatment.

There are 609 M-1 systems, 37 P-1 systems, 11 G-1 systems, and 23 S-1 systems. Staffing at these plants includes 1,445 certified operators. There may be between 50 and 100 administrative personnel for these plants throughout the state and an estimated 70 biologists, chemists, and laboratory technicians involved in water testing and analysis. Each facility must have at least one certified operator at the equivalent or higher classification, and there does not necessarily have to be a certified operator on-site to supervise operations. Many facilities have several certified operators, and, in many of the small utilities, all employees are certified operators.

It has not yet been decided if Wisconsin will apply for primary enforcement responsibility for the Safe Drinking Water Act. A review of the legal requirements for compliance with SDWA indicates that certain statutory changes will be required, and state government sources do not know whether these changes can be developed, submitted to the State Legislature, and acted upon in time to meet the April 1, 1977 deadline for making application for primacy. Moreover, there is no assurance that such changes would be passed by the Legislature. The state intends to

use an EPA Development Grant to address the legal issues regarding the acceptance of primacy. If primacy is accepted, it is anticipated that the only major program adjustment will be the expansion of surveillance activities to cover the additional water supplies included in the new Federal definition of a public water supply. The number of public water supplies under the new definition will expand to an estimated 22,000 from the current 680.

B. Workforce Profile

Data for the workforce profile was obtained through on-site and telephone interviews with professionals in the field. Mr. Carl J. Blabaum, Director, and Mr. Ralph C. O'Connor, Jr., Coordinator, Certification and Training, Bureau of Water Quality, Wisconsin Department of Natural Resources (WDNR), provided valuable assistance in the collection and compilation of this data.

Water supply activities are handled by WDNR, Bureau of Water Quality, Public Water Supply Section and Private Water Water Section. The activities of the Public Water Supply Section include program planning, inspection of public water systems, review of construction and modification plans for public water supply systems, investigation of consumer complaints, providing technical assistance and public information, and revision of statutes and administrative rules. The activities of the Private Water Supply Section include licensing new well drillers and pump installers, monitoring new well contruction, inspecting and evaluating water supplies, reviewing well construction requests, inspecting

well drillings, and providing consultative services to both technical people and laypersons requiring information regarding private water supply.

The current permanent professional and technical staffing level of the water supply program is approximately twenty. Operations are carried out through the central office in Madison and six district field offices located throughout the state. In the central office, eleven professional and technical personnel work in the water supply program. In the six district offices, a total of approximately nine person-years per year is devoted to water supply. In the district offices, the same staff carries out both waste water and water supply activities with most effort directed toward the waste water program. Therefore, person-years of effort is a more meaningful measure of effort toward the water supply program than is number of persons involved.

The current staffing level, by position, is shown in the following table. Note that the staffing level represents person-years of effort rather than total numbers of persons involved in water supply activities.

TABLE VI

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Water Supply Program
Current (1976) Staffing Level

Position	1976
Engineer	13
Sanitarian	5
Technician	1
Other	1
TOTAL	20

The engineers hold the position of environmental engineer. All are degreed and many are registered professional engineers. Training includes environmental, chemical, civil, mechanical, and industrial engineering. The sanitarians are degreed scientists. The technician holds the position of engineering technician and is a degreed meteorologist. The "other" category represents the efforts of six operator instructors who collectively devote one person-year to the water supply program per year. The operator instructors are also degreed scientists, and many have prior teaching experience. Three authorized positions are currently vacant: one sanitarian, one environmental engineer, and one hydrogeologist.

Nineteen additional temporary positions are funded with Title X monies. These are field office positions and include three natural resource specialists (degreed scientists), one sanitarian, and fifteen engineering technicians. The engineering technician positions also tend to be filled by degreed scientists because of the tight job market for scientists.

The Wisconsin Laboratory of Hygiene, Environmental Science Section employs one microbiologist and three laboratory technicians in the Water Bacteriology Unit and seven chemists and seven laboratory technicians in the Water Chemistry Unit. Approximately four person-years per year are spent on water supply activities of a continuing nature and one and one-half person-years per year are devoted to activities related to the Safe Drinking Water Act.

The following table illustrates the distribution of certified treatment plant and distribution system operators by classification. This information was obtained from the certification records of WDNR.

TABLE VII

STATE OF WISCONSIN

Current (1976) Wisconsin Certified Water Treatment Plant and Water Distribution System Operators

Classification		1976
M-1		1062
P-1		165
G-1		53
S-1		165
	TOTAL	1445

WDNR is considering a change to separate certification of distribution system operators. WDNR sources do not anticipate that such a change would make a difference in the overall numbers of certified personnel.

WDNR sources estimate that there are 50 to 100 persons who are not operators working in administration for the utilities. Forty-eight water utilities have bacteriological laboratories. These laboratories are generally staffed by a biologist or other degreed scientist. Some laboratories have laboratory technicians, and some utilize the head operator or an assistant in this capacity. Approximately 20 chemists carry out required chemical testing. The numbers of operators to be certified and the numbers of maintenance and labor personnel are not available.

Field research suggests that there may be up to 2,000 professional, technical, and labor personnel employed in the municipal water supplies

in Wisconsin. In addition, approximately 25 professional and technical people are employed in the WDNR water supply program.

C. Workforce Projections

Workforce projections regarding potable water are based on the best professional judgment of experts in the field. WDNR sources expect little growth in the state potable water program as illustrated in the following table.

TABLE VIII

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Potable Water Operations
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	13	14	14	14	14	14	10%	2%
Sanitarian	5	7	7	7	7	7	n/a	8%
Technician	1	1	1	1	1	1	n/a	0
Other	1	5	5	5	5	5	n/a	80%
TOTAL	20	27	27	27	27	27		7%

It should be noted that four positions of the increase do not represent real staff growth. Instead, it is the expected conversion of one Title X sanitarian and three Title X natural resource specialists to permanent staff positions. The other three additions will result from filling the engineering, sanitarian and hydrogeologist vacancies. The 80% per annum average increase in the "other" category is the retention of the three natural resource specialists and the addition of a hydrogeologist. Although the department would like to convert additional Title X positions to permanent staff appointments, the state

Legislature is not expected to appropriate sufficient funds for this purpose, and fifteen Title X employees are likely to be lost after 1977. Twelve of the Title X engineering technicians were hired to conduct a water supply inventory pursuant to the Safe Drinking Water Act. Therefore, this staff is not an integral part of the water supply program. The Laboratory of Hygiene may add several additional chemists if Wisconsin accepts primacy for the Safe Drinking Water Act.

The turnover rate for engineers in the water supply program is approximately 10% per year. Many engineers are hired upon graduation from college, and after acquiring several years of governmental experience may be attracted to private sector jobs which tend to offer higher salaries.

With regard to the municipal water supplies, no further G-1 (lime softening) or S-1 (surface water) plants will be built. In fact, several G-1 plants will be closed and replaced with P-1 systems. The only hiring in these categories will be for replacement of turnover. Workforce projections for treatment plant operators, by classification, are shown in the following table.

TABLE IX

STATE OF WISCONSIN

Water Treatment Plant Operators and
Water Distribution System Operators
Workforce Projections to 1982 (est.)

Classification	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
M-1	1062	1197	1332	1467	1602	1737	10%	10%
P-1	165	170	175	180	185	190	5%	3%
G-1	53	52	51	51	51	51	5%	- 4%
S-1	165	165	165	165	165	165	5%	0
TOTAL	1445	1584	1723	1863	2003	2143		8%

Note that the M-1 classification has the lowest experience and skill requirements and that the requirements become progressively more difficult through P-1, G-1, and S-1. The certified treatment plant operator workforce is expected to grow by approximately 700 over the next five years as a result of new plant construction and the upgrading of existing plants. Furthermore, a proposed rule change to require that shift supervisors be certified operators, if adopted, would contribute to a growth in the certified operator workfo ce. The projected growth for certified M-1 operators includes persons working as operators but not yet certified. However, data on the number of operators of this type is not available.

It should be pointed out that the turnover rate for M-1 operators is 10% per annum. This represents a loss of approximately 100 M-1 operators each year. Since the overwhelming majority of potable water systems are of the M-1 type (609 of the 680 systems are M-1) few M-1 operators find it to their advantage to upgrade since upgrading would, in 90% of the plants, yield no advancement in position or salary. The generally low salaries available for M-1 plant operators combined with little opportunity for advancement, then, contributes to the high turnover rate among M-1 operators. Since the other three types of treatment plants do offer greater opportunities for salary and position advancement, employment is more stable. The turnover rates in these plants averages about 5% per annum.

Because administrative and laboratory functions at municipal water supply systems are already well staffed, sources in the field expect little change over the next five years in the numbers of persons

employed in these positions. Even the prospective increase in the amount of chemical analysis required under the Safe Drinking Water Act probably will not result in increased staffing.

In summary, the WDNR potable water program will experience little actual staffing growth over the next five years. The only additions expected for this program is the conversion of four Title X employees to permanent status and the filling of three vacancies. In the municipalities, significant growth in the number of certified operators is expected to occur. Specifically, nearly 700 operators may be certified over the next five years. Some of these operators, it should be noted, are already employed at the municipal systems but have not yet obtained certification.

D. Training and Certification

WDNR is considering the revision of the certification program. If revision occurs, operators will no longer be required to learn the operation of systems other than the one in which they are employed to qualify for a higher classification. Instead, the new system would allow operators to advance within the type of treatment plant in which they work. Thus, instead of progressing from M-1 to P-1 to G-1 to S-1, an operator who is an M-1, for example, would progress through the stages of M-2 to M-3 to M-4. Furthermore, it is proposed that the general written examination for certification and upgrade be supplemented by a practical, hands-on examination for the particular treatment processes at the appropriate level of difficulty. This proposal is designed not only to improve operators' skills, but also to comply with

Equal Economic Opportunity guidelines and to provide more opportunities for upgrading. WDNR sources hope that improvement of the upgrading system will help reduce operator turnover.

In addition to these proposed changes, WDNR and the Wisconsin Board of Vocational, Technical and Adult Education (VTAE) are considering a plan to work cooperatively for operator training. Currently, three VTAE districts have two-year associate degree programs for individuals planning careers in waterworks and waste water treatment plant operations. The institutions offering these programs are Milwaukee Area Technical College, Southwest Wisconsin Vocational-Technical Institute, and Moraine Park Technical Institute. WDNR provides training for operators already working in the waterworks and waste water fields in the form of basic and advanced short courses, laboratory instruction, and in-plant assistance.

WDNR and VTAE are examining three areas in which VTAE can assist further in operator training. First, VTAE may be able to take over the basic WDNR training courses for more efficient delivery through the vocational/technical institution network to Wisconsin operators. Second, technical schools could serve as centers for self-study for operators who are unable to attend formal courses and for remedial instruction for those needing help in mathematics and communication skills. Third, the technical schools could provide continuing education courses in such areas as electrical and mechanical maintenance, biology of water treatment, and water chemistry. WDNR sources expect that a decision will be made concerning this proposal in the coming year.

Through the present system of operator training by the state, three district operator instructors conduct M-1 courses twice a year and the other three instructors conduct M-1 courses once a year. G-1, P-1, and S-1 operators are trained through statewide seminars held once a year. Finally, the Wisconsin Section of the American Water Works Association conducts four seminars every year for waterworks operators on a variety of subjects. Between 200 and 300 operators attend each year.

E. Career Potential

The proposed certification system, if adopted, may improve career opportunities for certified operators. The proposed system is designed to encourage upgrading and accordingly, to reduce operator turnover. Ideally, an upgrade in certification would be accompanied by a salary increase. While this is possible in the larger cities, it is unlikely to occur in the smaller communities because of fiscal constraints. The absence of a salary increase may tend to weaken the incentive to upgrade. Sources in the field suggest that career opportunities do, however, exist in the smaller villages. Because much of the present workforce is approaching retirement age, advancement of operators to supervisory positions is more likely to occur in the smaller communities.

The three Wisconsin technical colleges which offer two-year associate degree programs in waterworks and waste water report 75-100% placement rates for their graduates, with some graduates choosing to continue their education rather than to seek jobs. It should be noted that more graduates have found jobs in the waste water field than in waterworks.

Those who do become involved in waterworks operations are often hired by the smaller communities to run both the waste water and waterworks systems. Sources in the field note that many communities prefer to hire their own residents to work in the municipal systems even if more highly qualified nonresidents are available for the job.

F. Conclusion

It has not yet been determined whether Wisconsin will accept primary enforcement responsibility for the Safe Drinking Water Act. If primacy is assumed, an estimated 21,460 additional systems will come under the new federal definition of a public water supply. Most of the public systems under the new definition are expected to be of the M-1 type. Whether or not primacy is accepted, no significant staffing growth is expected in the WDNR water supply program.

Career opportunities which do become avaiable will be chiefly for treatment plant operators. Over the next five years an estimated 700 individuals will become certified operators. Part of this figure represents a net growth in the workforce employed in water supply due to the construction of new plants and the upgrading of existing ones. Other operators are already employed at municipal waterworks but are not yet certified. The fact that there is projected to be a demand for approximately 700 additional certified operators over the next five years indicates a sizable training need. WDNR plans to address this need through cooperation with VTAE by which operator training would be carried out through the state's vocational/technical education delivery system, and through possible changes in the system of operator

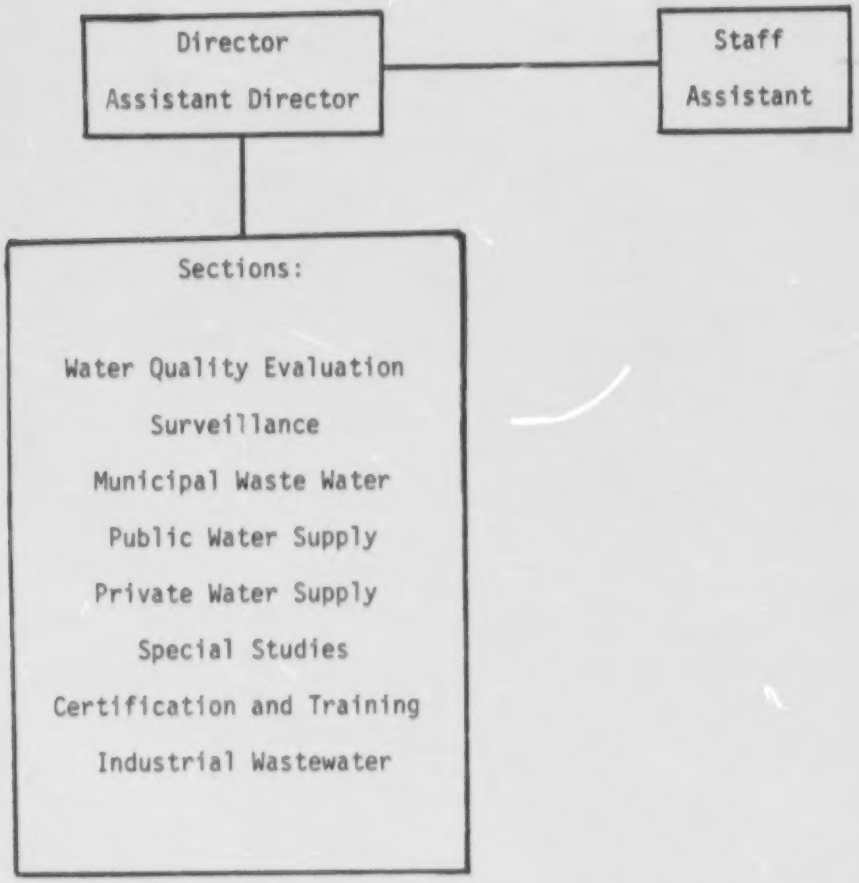
certification. The proposed changes in the certification system are designed to enhance the affirmative action program, to encourage operators to acquire those skills appropriate to their specific job duties, and to decrease the rate of operator turnover. This last goal may be difficult to accomplish unless operator upgrade is accompanied by salary increases.

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Division of Environmental Standards

Bureau of Water Quality

Figure 6



V. RADIATION

A. Introduction

Principal responsibility for radiation protection is vested in the Wisconsin Department of Health and Social Services (WDHSS), Bureau of Environmental Health, Radiation Protection Section. This Section is responsible for carrying out the regulatory program for dental/medical and industrial X-ray, for environmental monitoring around nuclear power plants, for the statewide milk sampling program, and for control of all forms of ionizing radiation that are not already licensed by the U.S. NRC. Wisconsin is not an NRC agreement state. The Radiation Protection Council, a nine-member body, provides the Department with technical assistance in the administration of the Radiation Protection Act and in the development of rules and regulations.

B. Workforce Profile

Data for the workforce profile and workforce projections were obtained through on-site and telephone interviews with professionals in the field. Mr. Lawrence McDonnell was of particular assistance in the collection and compilation of this data.

The Radiation Protection Section has a professional staff of five to conduct the activities described above. The staffing of this Section is as set forth in Table X on the following page.

TABLE X

WISCONSIN DEPARTMENT OF HEALTH AND SOCIAL SERVICES

Radiation Protection Section
Current (1976) Staffing Level

Position	1976
Physicist	1
Chemist	1
Technician	2
Other	1
TOTAL	5

The "Other" category includes the section administrator. The chemist is a degreed radiation chemist. The physicist is a health physicist and the technicians are registered radiation technologists. The physicist and technicians are classified as radiation consultants and conduct field surveys. The State Laboratory of Hygiene has a Radiation Protection Unit staffed by one chemist.

Private sector data concerning the numbers of individuals employed to protect the environment for excessive radiation are tentative at this time. The number of facilities using industrial X-ray devices in Wisconsin is 87. Each of these facilities is required to have a safety officer, often an industrial hygienist, responsible for the proper use of the equipment. In addition, the 1,007 hospitals and 300 clinics using medical diagnostic machines may also have one person in each facility responsible for the equipment. These persons may be health physicists, although in smaller clinics this may not be the case.

There are three nuclear power plants in Wisconsin and one on the Wisconsin-Minnesota border. These plants also have persons who are responsible for environmental control, as well as operational personnel who

require a specialized knowledge of the operation, maintenance, and repair of nuclear equipment.

C. Workforce Projections

Sources in the field indicate that there will be a net increase in the workforce employed in radiation protection in Wisconsin by the early to mid 1980s. The majority of growth will be the result of the planned construction of two additional nuclear power plants.

Staffing projections for the Wisconsin Department of Health and Social Services, Radiation Protection Unit are as follows: there will be an addition of one radiation consultant by 1978. This position will require a bachelor's or master's degree in physics, health physics, or a related science. By 1980 there will be an additional health physicist and a laboratory person, either a chemist or a technician. Thus, over the next five years, this Section expects to experience a staffing increase of three professional and technical people. It is anticipated that the increase in radiation consultants will reduce the time between field surveys of larger facilities, particularly hospitals. Also, this additional workforce will be used for environmental monitoring of the planned nuclear power plants. The Laboratory of Hygiene may add one or two chemists when the nuclear power plants begin operation.

In the private sector, little growth is anticipated in the workforce involved in the industrial use of X-ray equipment. Growth will occur when the two anticipated nuclear power plants are built, but the number of people who will be involved in environmental protection is not available at this time. Certainly reactor operators, health physicists, the

security force, plumbers, and maintenance personnel will all require a working knowledge of radiation.

D. Training and Certification

Wisconsin Department of Health and Social Services, Radiation Protection Unit, provides informal on-the-job training for its new entrants. It also cooperates with various vocational/technical institutions and universities. Cooperation occurs on an informal basis with the Unit providing lecturers on request.

Physics and health physics training is offered at the universities throughout the state. Professionals in the field point out that a traditional physics background is often better preparation for work in radiation control than is training in health physics. They suggest that health physics curricula sometimes fail to stress the basic principals of physics. Consequently, graduates may lack adequate knowledge of radiation theory and measurement.

E. Career Potential

Career opportunities may develop in the 1980s as a result of the construction of nuclear power plants. Many of the professional and technical positions at these plants will require a working knowledge of various aspects of radiation.

F. Conslusion

Growth in the radiation protection field will result from the planned construction of two nuclear power plants. The Wisconsin Department of Health and Social Services, Radiation Protection Section expects its professional and technical staff to increase from its present level of five persons to eight persons by 1981. Workforce projections for the private sector are not available at this time.

VI. SOLID WASTE

A. Introduction

Wisconsin has approximately 1,300 active licensed landfills throughout the state handling solid waste other than automobiles. Nine hundred fifty of the landfill sites serve populations of less than 2,500, while 350 serve larger populations and are covered daily. Over 400 sites have been identified in problem locations, but state government sources indicate that it will be several years before the poorly located sites can be closed and replaced with better solid waste management practices.

The Solid Waste Management Program, carried out by the Wisconsin Department of Natural Resources (WDNR), Bureau of Air Pollution Control and Solid Waste Management, Solid Waste Management Section was originated in 1969. It was basically oriented toward licensing and determining minimum standards. Later legislation broadened the scope of the program by adding county planning, environmental impact procedures and analysis, regulation of liquid waste haulers, and additional responsibilities under Section 208 of the Federal Water Pollution Control Act Amendments. The Air Pollution Control Council, a seven member council appointed by the Governor, serves the WDNR in an advisory capacity in solid waste control, as well as in air pollution control matters.

Wisconsin is becoming extremely active in the field of resource recovery to deal with the enormous growth anticipated in the generation of solid waste in the state. According to a booklet produced by the Wisconsin Solid Waste Recycling authority entitled, "Wisconsin Solid Waste Recycling", the state's solid waste quantities are predicted to grow from 12,825 tons per day in 1975 to 17,200 tons per day by 1985. In 1974, the Wisconsin

Legislature passed legislation to create the Wisconsin Solid Waste Recycling Authority. A quasi-public organization, the Authority is empowered to implement statewide recycling projects on a region-by-region basis. Recycling plants will be financed by the sale of revenue bonds which will be self-amortizing from dumping fees and sale of recycled material. Private industry will be utilized as much as possible in all phases of recycling, and in fact, facilities will be leased to private industry to operate. To ensure a continuous supply of reclaimed materials for manufacturing new products, the Authority can require solid waste generators to use the recycling facilities. The first plant is expected to be open in January 1979 and is targeted to handle 1,250 tons of solid waste per day.

B. Workforce Profile

Data for the workforce profile and workforce projections was obtained from on-site and telephone interviews with professionals in the field. Valuable assistance in the collection of these data was provided by Mr. E. Brooks Becker, Director, Bureau of Air and Solid Waste Management, WDNR; Mr. John J. Reinhardt, Chief, Solid Waste Management Section, WDNR; Mr. John Reindl, Residue Waste Management Specialist, University of Wisconsin-Extension; and Mr. J. R. Castner, Director, Wisconsin Solid Waste Recycling Authority.

The WDNR, Solid Waste Management Section carries out its functions through its main headquarters located in Madison and five district offices. This Section employs a permanent professional staff of 24. About half the staff is located at the Section headquarters and the other half is allocated to the district offices. The staffing level, by position, is shown in the following table.

TABLE XI

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Solid Waste Management Section
Current (1976) Staffing Level

Position	1976
Engineer	8
Geologist	2
Scientist	12
Other	2
TOTAL	24

The engineers are classified as environmental engineers, although they have a variety of engineering backgrounds including civil, mechanical, and chemical. All are degreed and some are registered professional engineers. One geologist is a hydrogeologist. The other geologist and the scientists work as solid waste investigators. The scientists have degrees in such disciplines as biology, forestry, soils, and resource management. Two authorized positions are vacant: one environmental engineer and one licensing coordinator.

The Solid Waste Management Section employs ten Title X personnel: seven natural resource specialists (degreed scientists), two engineering technicians, and one natural resource specialist technician. Although the latter two positions technically require less than a bachelor's degree, the abundance of degreed scientists in the labor market tends to cause these positions to be filled by the degreed scientists. Title X personnel are employed in the district offices.

Sources in the State Solid Waste Management program point out that the program has never had sufficient staff, even with Title X employees, to do all the work directed by solid waste legislation. At the current staffing level, responsibilities are being met adequately in only a few program areas such as the issuance of annual licenses. Plan review, surveillance, site redesign and upgrading, enforcement, and other program elements cannot be conducted at adequate levels. Moreover, new program responsibilities have been assigned to the program as a result of the Wisconsin Environmental Policy Act and the Wisconsin Recycling Act which demand a significant amount of staff resources. However, increases in staff or monies have not been allocated to support these additional responsibilities, and WDNR sources anticipate that the Federal Resource Conservation and Recovery Act of 1976 will constitute a further drain of staff resources.

The Wisconsin Solid Waste Recycling Authority has an authorized professional and clerical staff of 40. Five professional positions have been filled to date and include one director, one administrative assistant, two engineers, and one scientist.

The private sector and the municipal solid waste workforce consists of persons engaged in collection, disposal, resource recovery, and consulting. An overview of this workforce is shown on the following page in Table XII.

TABLE XII

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Private Sector and Municipal Solid Waste Workforce
Current (1976) Staffing Level (est.)

Position	1976
Landfill owner/operator	1100
Engineer	35
Geologist	5
Heavy Equipment Operator	525
Weighmaster	15
Complex Machine Operator	7
TOTAL	1687

The number of landfill owner/operators is an estimate based on the fact that there are a total of 1,300 licensed landfills in the state. Nine hundred fifty of these landfills are generally open only two days each week, and some owner/operators run more than one landfill. Most of the engineers and geologists are employed by consulting firms which work on the design of land disposal facilities. The number of heavy equipment operators is estimated on the basis of the 350 sanitary landfills in the state averaging one to three heavy equipment operators each. The complex machine operators are employed at municipal resource recovery sites in the City of Madison and Outagamie County. These facilities have solid waste shredders and magnetic separation. In addition, an estimated 4,000 persons are employed in collection of solid waste. No information is available concerning the workforce employed in privately owned and operated resource recovery facilities.

To summarize, nearly 40 professional and technical personnel are employed in the WDNR, Solid Waste Management Program and by the Wisconsin Solid Waste Recycling Authority. In the municipalities and the

private sector, there may be a workforce of more than 6,000 professional, technical, and labor personnel employed in solid waste collection and disposal, resource recovery and consulting.

C. Workforce Projections

Workforce projections are based on the best professional judgment of persons working in the solid waste management field. Sources at WDNR have made the following projections for the Solid Waste Management Section.

TABLE XIII

STATE OF WISCONSIN

Bureau of Solid Waste Management
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	8	9	10	11	12	13	10%	10%
Geologist	2	3	3	4	4	4	n/a	17%
Scientist	12	13	13	14	14	15	5%	5%
Other	2	2	2	2	2	2	n/a	0
TOTAL	24	27	28	31	32	34		7%

Most staffing growth is expected to result from the conversion of Title X employees to permanent staff positions and, therefore, does not represent an actual staffing increase. Sources at the WDNR indicate that the Resource Conservation and Recovery Act of 1976 could result in the need for about ten additional staff members, engineers, lawyers, scientists, and geologists, to conduct studies and surveys, revise the State Plan, draft new legislation, and draft new rules and regulations. Despite the possible need for such a staff increase, it is uncertain whether funds will be available for this purpose.

The average annual turnover rate of engineers is approximately 10%. Much of this turnover is caused by the fact that the engineers tend to be hired upon graduation from college and after several years of experience may accept jobs in the private sector where salaries are often higher. The turnover rate for scientists is lower, about 5% per year. The turnover rate may be lower for scientists because fewer private sector opportunities are available for them.

Sources at the Wisconsin Solid Waste Recycling Authority expect to fill the authorized professional positions as follows.

TABLE XIV

STATE OF WISCONSIN

Wisconsin Solid Waste Recycling Authority
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	2	7	11	16	16	16	n/a	62%
Attorney	0	2	3	3	3	3	n/a	50%
Scientist	1	3	5	7	7	7	n/a	61%
Other	2	5	8	11	11	11	n/a	50%
TOTAL	5	17	27	37	37	37		67%

The "Other" category includes mostly finance and marketing personnel. Authority sources indicate that people will be recruited from existing professions, i.e., engineering, management, although a background in solid waste management will be preferred. New entrants will receive on-the-job training. Turnover rates are not estimated because of the youth of the organization.

The following workforce projections for solid waste collection and disposal are based on the best professional judgment of WDNR sources. The projections for solid waste disposal have been made on the basis

of staffing levels at the 350 sanitary landfills. The 950 remaining sites are one person operations. Approximately 400 of these landfills will be closing over the next several years, thus reducing the size of the workforce.

TABLE XV

STATE OF WISCONSIN

Solid Waste Collection and Disposal Workforce
Workforce Projections to 1982 (est.)

Collection	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Driver	1,500	1,530	1,560	1,590	1,620	1,650	n/a	2%
Jumper	2,500	2,545	2,590	2,635	2,680	2,725	n/a	2%
Disposal								
Weighmaster	15	15	15	15	15	15	n/a	0
Heavy Equip. Operator	525	525	525	525	525	525	n/a	0
Foreman	50	50	50	50	50	50	n/a	0
Spotter	100	100	100	100	100	100	n/a	0
Other	20	20	20	20	20	20	n/a	0
TOTAL	4,710	4,785	4,860	4,935	5,010	5,085		2%

The 2% growth in workforce employed in collection will result from the increase in the volume of solid waste generated. Offsetting factors to growth will be changes in the container system which allow trucks to compact more, and municipal unionization, the costs of which will tend to cause municipalities to opt for private collection. Private contractors tend to utilize smaller crews.

Employment in disposal is expected to remain fairly constant. Some of the smaller sites which are not sanitary landfills will be closing, and the larger sites will become more capital intensive in the next several years.

Current municipal resource recovery activities consist of the shredding and magnetic separation operations in the City of Madison and in Outagamie County. These facilities employ an estimated 14 persons as complex machine operators, mechanics, and laborers.

A resource recovery facility has recently begun operation in Milwaukee. It is run by a private firm under contract to the City, and Milwaukee has the option to purchase the system after five years of operation and, again, after ten years. The system is designed for shredding, magnetic separation, and air classification. It is expected to be fully operational by the spring of 1977. Administrative sources for this facility estimate that the full staffing complement will be as follows.

Position	1977
Foreman	3
Assistant Foreman	2
Scale Operator	2
Loader Operator	3
Picker	16
Maintenance Mechanic/Electrician	11
Welder	3
Compacter Operator	6
Truck Spotter	4
Utility Workers	8
Administration	10
TOTAL	68

An additional resource recovery facility, also capable of shredding, magnetic separation, and air classification will be implemented under the auspices of the Wisconsin Solid Waste Recycling Authority. It is expected to begin operation in 1979 in the Fox River Valley area. Authority sources estimate that the plant will employ approximately 30 persons,

including laborers, managers, equipment operators, and maintenance personnel. The distribution of personnel among these positions cannot yet be ascertained. No further resource recovery facilities are expected to be built by 1981, although additional facilities are planned by the Authority for the 1980s.

There will be no appreciable growth, then, in the State Solid Waste Management Program since most new additions will represent the conversion of Title X employees to permanent staff status. The Solid Waste Recycling Authority, a quasi-public organization, will be hiring approximately 35 more professionals over the next five years. The workforce employed in solid waste collection will increase by approximately 2% per annum or 375 persons over the next five years, while the workforce employed in disposal is expected to remain constant. Between 1977 and 1981, the professional, technical, and labor workforce employed in resource recovery may experience an increase of over 100 persons.

D. Training and Certification

WDNR identifies training priorities for solid waste management each year and coordinates programs to address those priorities. For fiscal year 1976, the priority areas include:

1) Training of WDNR solid waste staff, through three in-house workshops, in the technology of solid waste management, solid waste laws, and policies and procedures;

2) Training of public officials, on a district by district basis, in the basics of solid waste management;

3) Training of landfill operators and managers, on a district by district basis, in the proper techniques of day-to-day operation and management of municipal sanitary landfills.

Training is conducted by WDNR staff, outside experts, and University of Wisconsin-Extension. The University of Wisconsin-Extension also sponsors about four technical conferences each year which are pertinent to solid waste management. In addition, the various University of Wisconsin campuses offer seminars in solid waste management, some for graduate engineers and others for people with less technical backgrounds.

Professionals involved in these training programs agree that landfill operators require additional training in such areas as the environmental impact of various landfill practices, proper use of machinery, handling of hazardous wastes, and record keeping. Also, as resource recovery develops, training is needed for managerial personnel who will require a specific understanding of the operation of resource recovery facilities, and for mechanics and electricians who must be skilled in the maintenance and repair of sophisticated resource recovery equipment.

E. Career Potential

In the solid waste management field, resource recovery will certainly offer the greatest prospects for career development. Civil engineers, geologists, and hydrogeologists who have specialized in solid waste management and resource recovery will find career opportunities in planning and designing resource recovery facilities. Much of the equipment presently used for resource recovery was originally designed for other purposes and, therefore, is not always wholly adequate for use in resource recovery. Accordingly, highly trained engineers are needed for equipment design. Mechanics, electricians, laborers, supervisors, and

administrators who are knowledgeable in solid waste management and resource recovery will also be in demand. Especially desirable in terms of administrative personnel, according to sources in the field, is a scientific or engineering background in solid waste and resource recovery combined with a comprehensive understanding of local political structures and management techniques. Sources in the field point out that while mechanics, electricians, and laborers will require special skills for working in resource recovery, these jobs offer little opportunity for advancement. Although there will be some increase in the workforce engaged in collection of solid waste, this type of job, again, offers little opportunity for advancement and, in addition, often provides poor working conditions.

F. Conclusion

To deal with the increasing quantities of solid waste being generated, Wisconsin has become increasingly active in the field of resource recovery. The youth and complexity of recycling technology will create a variety of job opportunities. Equipment presently used in resource recovery has usually been designed for other purposes. Consequently, engineering firms and equipment manufacturers will be seeking engineers to design new equipment that is more appropriate for resource recovery. Mechanics and electricians will have to obtain skills for working on the sophisticated machinery that is used in resource recovery operations. While technical colleges are currently equipped to provide training in basic equipment maintenance, supplementary training will be necessary in the maintenance and repair of resource recovery equipment. Such

training might effectively be provided through EPA or technical institution sponsored short courses.

As waste management systems become larger and more complex, the need for additional training of landfill operators is becoming increasingly apparent, and WDNR does not have sufficient resources for addressing this training need. If adequate funding for this purpose is not forthcoming, EPA or technical institution short courses could again help meet this need.

The Resource Conservation and Recovery Act of 1976 will affect the emphasis of the WDNR, Solid Waste Management Program and may require an increase in staffing greater than that shown in Table III. Increased attention will be given to hazardous waste management. Studies on this subject will be conducted to assess the state situation, and comprehensive hazardous waste legislation is planned. Industry will have to put additional effort into managing its hazardous wastes. However, workforce implications for industry cannot yet be determined.

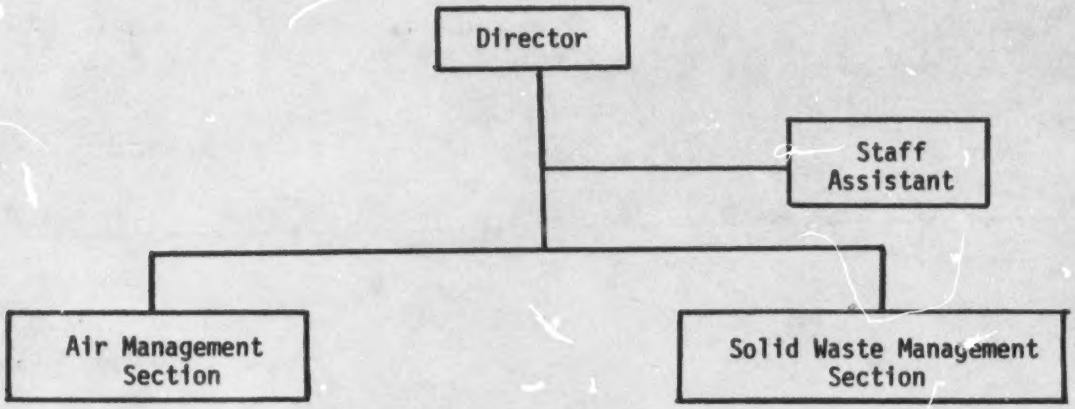
Perhaps the greatest problem of the state solid waste management program is the continued insufficiency of staff resources. While the WDNR, Solid Waste Management Section is continually assigned new responsibilities, additional money has not been allocated to allow most responsibilities to be carried out adequately.

Figure 7

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Division of Environmental Standards

Bureau of Air and Solid Waste Management



VII. WASTE WATER

A. Introduction

There are 663 municipal waste water treatment plants and approximately 50 industrial waste water treatment plants in Wisconsin. The municipal plants and municipal operator certification are divided into four classifications based on the amount of water flowing through the system daily: I) greater than three million gallons per day; II) one to three million gallons per day; III) 100,000 to one million gallons per day; and, IV) less than 100,000 gallons per day. There are 31 Class I systems, 48 Class II systems, 259 Class III systems, and 325 Class IV systems. Certification is required for both municipal and industrial treatment plant operators. However, in the case of industrial operators, certification is actually only a process of registration since it has no examinations, education, or experience requirements. Provisions for certification by examination for industrial operators are under consideration by the Wisconsin Department of Natural Resources (WDNR). There are approximately 1,950 certified and active waste water treatment plant operators in the state.

The WDNR, Bureau of Water Quality (BWQ) has regulatory responsibility for the state waste water pollution control program. Sources at the Bureau expect that the abatement of most point source pollution problems can be accomplished by 1983 if adequate funding for municipal construction and legislative support is maintained. According to the Wisconsin State Program Plan for Water Pollution Control for Fiscal Year 1977, secondary treatment plants in 386 communities require upgrading or

replacement, and 56 primary treatment plants need to be replaced with more advanced systems to be capable of meeting 1977 effluent limits. One hundred fifteen municipalities, 21%, have treatment systems capable of meeting 1977 standards. Of the 73 major industrial discharges in Wisconsin, 62 are expected to meet 1977 effluent limits.

Under Section 108 of PL 92-500, Wisconsin has received planning grants for three area wide planning agencies and funds for statewide water quality management planning. Area wide planning will address the problems of large urban areas with concentrations of population and industry, as well as the problems of rural areas with nonpoint source pollution problems. The three designated area wide planning agencies are the Southeastern Wisconsin Regional Planning Commission, the Fox Valley Water Quality Planning Agency, and the Dane County Regional Planning Commission. These agencies are expected to complete approvable program plans by 1978.

The priority objectives for the BWQ for Fiscal Year 1977 are the timely awards of municipal project construction grants, effective identification and enforcement of permit violations, water quality planning and water quality monitoring. To meet its proposed goals, Wisconsin will have approximately two hundred million dollars for treatment plant construction for Fiscal Year

B. Workforce Profile

Data for the workforce profile and workforce projections were obtained through on-site and telephone interviews with professionals in the field. Of particular assistance were the director of the Bureau of Water Quality

and the coordinator of Certification and Training, Bureau of Water Quality, Wisconsin Department of Natural Resources.

Waste water pollution control activities of the BWQ include inspection of municipal and industrial waste treatment facilities, review of construction plans, collection and evaluation of water quality data, enforcement of standards, and operator training and certification. These activities are carried out by the following sections: Special Studies, Water Quality Evaluation, Surveillance, Municipal Waste Water, Industrial Waste Water, and Water Quality Planning.

The current permanent professional and technical staffing level of the waste water pollution control program is 148. Operations are carried out through the central office in Madison and the six district field offices located throughout the state. In the central office, 81 professional and technical personnel work in this program. The remaining 67 persons are allocated to the field offices. The current staffing level by position is shown in the following table.

TABLE XVI

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Waste Water Pollution Control Program
Current (1976) Staffing Level

Position	1976
Engineer	74
Chemist	12
Biologist	20
Laboratory Technician	5
Other	37
TOTAL	148

The engineers are assigned the position of environmental engineer. All are degreed and many are registered professional engineers. Training includes environmental, chemical, civil, mechanical, and industrial engineering. The chemists and biologists hold the position of environmental specialist and have, at the minimum, a bachelor's degree. The "Other" category includes the director, deputy director, fourteen degreed scientists who work as environmental specialists, twelve planners--two are degreed economists and eight have advanced degrees in water resource management--two management information specialists, one water quality modeler, and six operator instructors. The operator instructors are degreed scientists. Many have prior teaching experience. Fourteen authorized positions are vacant. The vacancies are distributed throughout most types of positions. Because of delays caused by the Civil Service process for hiring, fourteen vacancies represents the usual number for the program at any time.

Further, the BWQ has 22 temporary Title X employees allocated to the waste water pollution control program. These positions are as follows: 10 engineering technicians, 6 natural resource specialists (degreed scientists), one environmental engineer, and 5 management information technicians. Although the position of engineering technician does not require a college degree, these positions tend to be filled by degreed scientists because of the scarcity of jobs for scientists.

The Wisconsin Laboratory of Hygiene, Environmental Science Section employs one microbiologist and three laboratory technicians in the Water Bacteriology Unit and seven chemists and seven laboratory

technicians in the Water Chemistry Unit. These units devote part of their time to waste water analysis. In total, then, in the state waste water pollution control program, there is a professional and technical workforce of about 188 persons.

The following table illustrates the distribution of certified waste water treatment plant operators by classification. This information was obtained from the certification records of WDNR.

TABLE XVII

STATE OF WISCONSIN

Certified Waste Water Treatment Plant Operators
Current (1976) Staffing Level

Classification	1976
I	237
II	168
III	558
IV	886
TOTAL	1,849

The above total of 1,849 is an estimate of the number of operators who are actively working either in municipal waste water treatment plants or for engineering firms. In addition, 110 operators of industrial waste water treatment plants are certified by WDNR. No information is available concerning the number of waste water treatment operations personnel other than certified operators.

In summary, the state waste water pollution control program, including the State Laboratory of Hygiene, employs nearly 190 professional and technical personnel. The municipal and industrial waste water treatment plants and engineering firms have a total of nearly 2,000 certified operators on their staffs. Assuming that many municipal

waste water treatment systems employ at least one person other than the certified operators, it may be estimated that a workforce of approximately 3,000 is employed in waste water treatment operations in Wisconsin.

C. Workforce Projections

WDNR sources expect little growth in the waste water pollution control program in the next five years. The following table illustrates workforce projections for the BWQ.

TABLE XVIII

BUREAU OF WATER QUALITY

Waste Water Program Operations
Workforce Projections to 1982 (est.)

Position	1976	1977	1978	1979	1980	1981	%/annum turnover (average)	%/annum growth (average)
Engineer	74	74	74	74	74	74	10%	0
Chemist	12	12	12	12	12	12	3%	0
Biologist	20	20	20	20	20	20	3%	0
Technician	0	5	5	5	5	5	n/a	100%
Lab Technician	5	5	5	5	5	5	n/a	0
Other	37	42	42	42	42	42	3%	3%
TOTAL	148	158	158	158	158	158		1%

The one percent increase in staffing over the next five years represents the expected conversion of five Title X engineering technicians and five Title X natural resource specialists to permanent status. Note that the 100% average per annum increase in technicians is the addition of five Title X technicians to the permanent staff. Because the average per annum increase for technicians is calculated from a 1976 base of zero, it tends to exaggerate the amount of growth expected in the technician

position. Ten of the Title X employees probably will be dropped after 1977. Consequently, the BWQ waste water pollution control program will actually experience a net decline of twelve persons between 1976 and 1981.

WDNR is considering instituting major changes in the certification process for waste water treatment plant operators. Similar to the changes being considered for the water supply program, the proposed certification system is geared toward training operators to become more skilled in operating the specific plant in which they are employed, rather than requiring them to learn about other types of plants. The proposed system, if implemented, is expected to encourage operator upgrading and to decrease the rate of operator turnover, a particular problem in the operator IV classification.

Sources at WDNR estimate that between 170 and 200 new operators will be certified each year in the beginning classification levels regardless of whether the existing or proposed certification system is used. If the proposed system is implemented, upgrades in the higher levels of certification are predicted to occur at a rate of between 20 to 30 annually and upgrades in the lower levels of certification are predicted to occur at a rate of 60 to 70 annually.

WDNR sources estimate that the average annual turnover rate for the highest three classifications, I, II, and III, is between six and seven percent. In the lowest classification, IV, turnover is much higher. Although specific estimates of turnover could not be obtained, WDNR sources report that operator turnover is a severe problem in the IV classification and that the turnover rate in this category has been

increasing over the past several years. Contributing to the high rate of turnover is the low pay for treatment plant operators in the small communities and the limited opportunities for upgrade. While operators who run Class IV treatment plants can earn a higher certification, they often do not receive a concomitant pay increase from the municipality in which they are employed. As a result, the incentive to upgrade and, indeed, to remain at the job is limited in the communities with Class IV treatment plants.

If the number of certified treatment plant operators does increase by 170 to 200 persons per year over the next five years, there will be a total increase of between 850 and 1,000 newly certified operators by 1981. The large demand for treatment plant operators will be the result of the new plant construction and modification, and strict enforcement of effluent limits. Also, the proposed operator certification code would contribute to an increase in demand for certified operators by requiring that on-site and shift supervisors be certified. Currently, only one employee per system is required to be certified at the grade of the system or at a higher grade. Some of the demand for certified operators will be filled by new entrants to the field, while some will be filled by operators already working at the treatment systems but not certified. No statistics are available concerning the magnitude of each of these categories.

Thus, the WDNR waste water pollution control program will experience little actual staffing growth over the next five years. The only additions that are expected for this program is the conversion of ten of the 22 Title X employees to permanent staff positions. In the municipal waste water treatment systems, significant growth in demand should develop

for certified treatment plant operators. Specifically, between 850 and 1,000 persons are expected to become certified over the next five years. In the industrial systems the demand for certified operators may also increase as a result of stringent regulations and enforcement which may necessitate larger staffing and plant construction.

D. Training and Certification

The proposed operator certification system mentioned above is designed not only to improve operators' skills in running the plant in which they are employed but also to comply with the Equal Economic Opportunity guidelines and to provide more opportunity for upgrading. WDNR sources hope that an improvement in the upgrading system will help reduce operator turnover. The proposed system provides for the written examination for certification and upgrade to be supplemented by a hands-on practical examination.

As with the potable water program, WDNR and the Wisconsin Board of Vocational, Technical and Adult Education (VTAE) are considering a plan to work cooperatively for operator training. Currently, three VTAE districts have two-year associate degree programs for individuals planning careers in waste water and waterworks treatment plant operation. The institutions offering these programs are Milwaukee Area Technical College, Southwest Wisconsin Vocation-Technical Institute, and Moraine Park Technical Institute. WDNR provides training for operators already working in the waste water and waterworks field in the form of basic and advanced short courses, laboratory instruction, and in-plant assistance.

Three areas in which VTAE may further assist in operator training are as follows: First, VTAE may be able to take over the basic WDNR training courses for more efficient delivery to Wisconsin operators; second, technical schools could serve as centers for self-study for operators who are unable to attend formal courses and for remedial instruction for those needing help in math and communication skills; third, the technical schools could provide continuing education courses in such areas as electrical and mechanical maintenance, biology of waste water treatment, and water chemistry. WDNR sources expect that a decision will be made concerning this proposal in the coming year.

Presently, the six WDNR district operator instructors spend a total of five person-years per year training waste water treatment plant operators. Two districts offer one basic operator course each year while four districts offer two of these courses each year. In total, between 150 and 200 persons attend these courses annually. The University of Wisconsin-Extension offers a two-week advanced course for operators. Other training includes a maintenance course sponsored by WDNR and a training course for operators who have been promoted to supervisory positions. This course is also conducted by University of Wisconsin-Extension.

Estimated person-hours of training for Fiscal Year 1977 for WDNR professional staff involved in water pollution control are shown on the following page.

Training	Person-Hours
University Credit Courses	1,000
University Noncredit	900
New Employee Orientation	300
EPA Specialized Courses	1,200
In-service Training	2,000

E. Career Potential

The proposed certification system, if adopted, is expected to encourage upgrading and reduce turnover, thus improving career opportunities for certified treatment plant operators. Ideally, an upgrade in certification would be accompanied by a salary increase. While this occurs in the larger cities, it is less prevalent in the smaller communities. If the smaller communities cannot or will not provide salary increases for operators who upgrade their certification, operators will have little incentive to upgrade their skills and remain on the job. However, sources in the field suggest that career opportunities are not precluded in the smaller communities since many personnel currently employed there are approaching retirement age. Consequently, more supervisory positions will be available.

Sources at the Wisconsin vocational/technical schools which offer operator education indicate that career opportunities in the waste water field are available both in municipal waste water treatment systems and with private and industrial engineering firms. Some industries such as electric power and paper and pulp utilize graduates of these programs in recently established environmental laboratories. Other firms hire these graduates to conduct field sampling and monitoring of water treatment equipment that has been installed around the state. A serious problem

for prospective municipal waste water treatment system operators is the fact that many communities prefer to hire their own residents to work in these systems. In many cases, in fact, a community will hire a resident even if a more highly qualified nonresident applies for the job.

F. Conclusion

Although the state waste water pollution control program will experience limited growth over the next five years, the demand for certified operators for municipal waste water treatment systems will increase significantly. There may be a demand for up to 1,000 additional certified operators by 1981 as a result of new plant construction, plant modification, and stringent effluent limitations and enforcement. Some of the operators who become certified will be new employees, while others are already employed at the municipal systems but not certified. In addition, the industrial waste water treatment systems may require more operators to comply with effluent limitations.

For all groups of operators, there is a substantial training need which the WDNR plans to meet through cooperation with VTAE and through possible changes in the system of operator certification. The proposed changes in the certification code are designed to enhance the affirmative action program, to encourage operators to acquire skills appropriate to their specific job duties, and to decrease the rate of operator turnover. This last goal may be difficult to accomplish unless operator upgrade is accompanied by salary increases.

VIII. ENERGY

A. Introduction

The Office of State Planning and Energy, the principal state energy agency, developed from the Office of Emergency Energy which was established according to Energy Policy and Conservation Act mandate. In September 1976, the energy agency merged with the Office of State Planning and shifted its activities from crisis energy management to energy policy planning. Since energy resources in Wisconsin are limited, energy policy is concerned more with conservation rather than energy development. The office is also developing a data base for energy use in the state.

B. Workforce Profile

The Energy Section of the Office of State Planning and Energy has six professional staff members: two have backgrounds in management, one is a physicist, one is a systems analyst, one is a computer programmer, and one is petroleum allocation specialist.

In the private sector, the electric utilities have one or two engineers involved in developing energy conservation programs and several nondegreed employees conducting energy audits for homes and businesses. There are at least two small solar manufacturers in Wisconsin, employing an estimated total of four engineers.

C. Workforce Projections

The Energy Section expects to hire one engineer in the coming year and anticipates no further growth over the next five years. More

emphasis will be placed on modeling and forecasting activities for which current staffing is considered adequate.

State legislation requiring the electric utilities to establish comprehensive energy conservation programs is currently in draft stage. If passed, the conservation-related staffs of the utilities can be expected to increase over the next five years. As solar technology advances, the number of solar engineers is expected to increase.

D. Training and Certification

Wisconsin colleges and universities offer energy-related engineering courses. Also, much of the training related to energy is conducted by University of Wisconsin-Extension. UW-Extension provides "public service" courses and information on energy with an emphasis on conservation. Approximately one person-year was spent in this area by county extension agents and Extension faculty in 1976.

UW-Extension also conducts engineering environmental programs related to energy of a continuing education nature. Courses include energy-heating, ventilating, and air conditioning, solar energy systems, solar heating, and energy conservation.

E. Career Opportunities

Career opportunities are expected to grow for highly trained scientists and engineers in basic and applied solar energy research. However, significant growth in this area may not occur for about ten years. Because of the need for energy conservation, there is a demand for people in the public and private sectors who are skilled in energy management.

This requires education in energy resources, energy technology, statistics, and economics.

F. Conclusion

The primary energy policy emphasis in Wisconsin is on conservation. The state is currently in the process of developing an energy data base and may require the electric utilities to design comprehensive energy conservation programs. The demand for people with training in alternative energy sources, especially solar, is expected to be fairly small over the next five years but to grow significantly in ten years.

Selected Post Secondary Institutions With Formal Environmental Energy Programs

Wisconsin's colleges and universities offer a wide variety of environmentally-related curricula. For example, Northland College, a liberal arts-environmental institution, provides an environmental emphasis option in nearly every program area. The various campuses of the University of Wisconsin offer environmental options in engineering and science programs. Examples of curricula on the community college - vocational/technical level which provide associates degrees are: Milwaukee Area Technical College, Environmental Health Technology; Southwest Wisconsin Vocational-Technical Institute, Municipal Engineering; Moraine Park Technical Institute, Water and Wastewater Technology; Austin Community College, Environmental Technology.

To provide information on the content of some of these programs, selected curricula offered by the University of Wisconsin and the Environmental Health Technology program of Milwaukee Area Technical College are described in greater detail on the following pages.

SENIOR INSTITUTIONS

University of Wisconsin
Madison, Wisconsin

Program: Civil and Environmental Engineering (M.S.)

Hours required for major: Semester - 24 to 30
Program Inception: 1973
Staff Size: Sixteen professors, eight associate professors, and six assistant professors.
Enrollment: 79
Graduates (1976): 33
Placement: not available
Graduate Work: not available

Courses (Selected) - Structural Engineering Option

City Planning
Advanced City Planning
Transporation Engineering
Highway Engineering
Municipal Engineering Practice
Environmental Impact of Transportation Systems
Urban Transportation Planning
Airports
Traffic Control
Highway Administration
Environmental Monitoring and Data Acquisition Seminar

Courses (Selected) - Water Resources Engineering Option

Hydroscience
Hydrology
Hydraulic Engineering
Sanitary Engineering
Design of Water Distribution and Water Collection Systems
Design of Water and Wastewater Treatment Plants
Solid Wastes Engineering
Optimization and Simulation of Water Resources Systems
Water Supply and Pollution Control
Air Pollution - Effects, Measurement, and Control
Industrial Waste Treatment
Radioactive Waste Treatment
Cost Engineering for Water Pollution Control
Water Analysis
Water Chemistry
Ocean Dynamics
Coastal Engineering
Ocean Environment

Courses (Selected) - Water Resources Engineering Option

Advanced Techniques of Water Analysis
Sanitary Engineering Process Principles and Design
Seminar in Water Resources Planning

Courses (Selected) - General Civil and Environmental Engineering Option

Economic Selection
Civil and Environmental Engineering Decision Making
Civil and Environmental Engineering Systems Modeling Techniques

SENIOR INSTITUTIONS

University of Wisconsin
Madison, Wisconsin

Program: Water Resources Management (M.S.)

Hours required for major: Semester - 30 to 45
Staff Size: Interdisciplinary - staff of various departments teach courses in this program.
Enrollment: 65
Graduates (1976): 23
Placement: 15 (estimate)
Graduate Work: 3

Courses

Aquatic Ecology for Nonbiologists
Principles of Ecology
Hydrology
Water Resources Engineering
Hydrogeology
Natural Resources Economics
Water Rights Law
Introduction to Regional Planning
Resource Policy Issues: Regional and National
Water Resources Economics
Economics of Public Decision Making
Optimization and Simulation of Water Resource Systems
Introduction to Statistical Methods
Quantitative Methods of Geographical Analysis
Interdisciplinary Workshop in Water Resources Planning and Management

SENIOR INSTITUTIONS

University of Wisconsin
Madison, Wisconsin

Program: Water Chemistry (M.S., Ph.D.)

Hours required for major: Semester - (M.S.) 18, (Ph.D.) 54
Program Inception: 1960
Staff Size: Six professors, two associate professors, one assistant professor (9 Ph.D.)
Enrollment: 25
Graduates (1976): 6
Placement: 5
Graduate Work: 1

Courses (Selected)

Water Supply and Pollution Control
Ocean Environment
Water Chemistry
Water Analysis - Intermediate
Marine Chemistry
Advanced Water Chemistry
Special Topics in Water Chemistry
Advanced Techniques of Water Analysis
Organic Water Chemistry
Problems in Oceanography
Water Chemistry Seminar
Water Chemistry Research Seminar

COMMUNITY COLLEGES/TECHNICAL INSTITUTIONS

Milwaukee Area Technical College
Milwaukee, Wisconsin

Program: Environmental Health Technology (A.A.S.)

Hours required for major: Semester - 64
Program Inception: 1971
Staff Size: two instructors (1 M.S., 1 M.P.H.)
Enrollment: 45
Graduates (1976): 17
Placement: 13
Graduate Work (B.S.): 3

Courses

Introduction to Environmental Health
Environmental Biology
Environmental Sanitation 1, 2
Water and Wastewater Technology
Air Pollution Technology
Food and Dairy Sanitation
Public Health Law and Administration
Field Experience

State Legislation

WISCONSIN GENERAL

TITLE:

Governmental Environmental Impact Statements
Wisconsin Statutes, Chapter 274

PURPOSE:

To encourage productive and enjoyable harmony between man and his environment, and to prevent or eliminate damage to the environment and stimulate the health and welfare of man.

DEFINITIONS:

ADMINISTERING AUTHORITY:

All State Agencies

AUTHORIZATIONS:

To prepare environmental impact statements for all proposed legislation and all other major actions which may affect the environment;
To review and revise regulations inconsistent with full attainment of improved environment.

WISCONSIN AIR/SOLID WASTE

TITLE:

Water, Ice, Sewage and Refuse Law
Wisconsin Statutes, Chapter 144

PURPOSE:

To organize and undertake a comprehensive program to enhance the quality, management and protection of the state's air resources.

DEFINITIONS:

1. Air contaminant
2. Air pollution
3. Emission
4. Solid waste
5. Garbage
6. Refuse
7. Solid waste disposal
8. Solid waste disposal sites and facilities
9. Environmental pollution
10. Toxic and hazardous substances
11. Solid waste management
12. Solid waste management plan

ADMINISTERING AUTHORITY:

Department of Natural Resources

AUTHORIZATIONS:

To issue regulations concerning air pollution control;
To make continuing studies of air pollution and motor vehicle emission effects;
To develop state air implementation plan;
To inspect property regarding air contaminants and solid waste disposal;
To approve construction of potential new air pollution sources;
To develop solid waste disposal standards;
To supervise local solid waste management plans.

PROHIBITED ACTS:

To emit air pollutants in excess of standards;
To make inoperable any motor vehicle pollution control device;
To discharge mercury in excess of allowed limits;
To maintain solid waste disposal sites not in compliance with standards;
To fail to report discharges of toxic substances, mercury, and certain air contaminants.

PENALTIES:

Fines of from $10 to $5,000.
Fines of from $200 to $10,000 for failure to report discharges.

WISCONSIN PESTICIDES

TITLE:

Wisconsin Pesticide Law
Wisconsin Statutes, Chapter 94.67

PURPOSE:

To provide a system for the registration, labeling and safety of pesticides.

DEFINITIONS:

1. Pesticide
2. Insecticide
3. Fungicide
4. Rodenticide
5. Herbicide
6. Nematocide
7. Insect
8. Fungi
9. Weed
10. Ingredient statement
11. Active ingredient
12. Inert ingredient
13. Registrant
14. Label
15. Labeling

ADMINISTERING AUTHORITY:

Department of Agriculture

AUTHORIZATIONS:

To require that pesticides not be adulterated or misbranded;
To require pesticide registration;
To issue regulations pursuant to the act, particularly relating to pests and pesticide toxicity;
To issue stop sale orders.

PROHIBITED ACTS:

To fail to properly register and label pesticides;
To detach, alter or destroy any label or labeling.

EXEMPTIONS:

Public officials, certain transporters, experimental users of pesticides, items consigned for export.

PENALTIES:

First offense - fine of from $100 to $200 or 30 days in prison;
Subsequent offenses - fines of from $200 to $500 or 90 days in prison.

WISCONSIN POTABLE WATER

TITLE:

Pure Drinking Water Law
Wisconsin Statutes, Section 162.01

PURPOSE:

To provide authority for obtaining pure drinking water, and to protect the public health from hazards of impure drinking water.

DEFINITIONS:

1. Department
2. Ground water
3. Well
4. Well drilling
5. Well driller
6. Pump installing
7. Pump installer
8. Permit

ADMINISTERING AUTHORITY:

Department of Natural Resources

AUTHORIZATIONS:

To issue regulations to ensure pure drinking water;
To suprevise methods of obtaining ground water for human consumption;
To enter property to inspect wells and equipment;
To require water supply analysis;
To issue permits for well drillers and pump installers.

CERTIFICATION OR LICENSING:

Retail outlets operated by well driller or pump installer are required to have permit.

PROHIBITED ACTS:

To engage in well drilling or pump installing without proper registration and permit.

EXEMPTIONS:

Wells not intended to produce water for human consumption.
No permit required of sanitary engineers.

PENALTIES:

Fines of from $10 to $100 or 30 days imprisonment.

WISCONSIN RADIATION

TITLE:

Radiation Protection Act
Wisconsin Statutes, Section 140.50

PURPOSE:

To encourage constructive uses of radiation and to prohibit and prevent exposure to ionizing radiation in amounts which may be detrimental to health.

DEFINITIONS:

1. By-product material
2. Nuclear facility
3. Radiation or ionizing radiation
4. Radiation installation
5. Radiation machine
6. Radioactive material
7. Radiation source
8. Source material
9. Special nuclear material

ADMINISTERING AUTHORITY:

Department of Health and Social Services
Department of Industry, Labor and Human Relations

AUTHORIZATIONS:

To develop policies concerning radiation hazards and uses;
To conduct studies concerning radiation hazards, effects, and related problems;
To enter and inspect property for purposes of radiation control;
To review and approve radiation source plans;
To register state radiation installations;
To issue regulations pursuant to the act;
To impound radiation materials.

CERTIFICATION OR LICENSING:

All radiation installations are required to be registered prior to operation.

PROHIBITED ACTS:

To operate a radiation installation without proper registration and approval.

EXEMPTIONS:

Radiation sources and nuclear reactor plants registered by the Atomic Energy Commission.

PENALTIES:

Fines of from $10 to $500;
Increased compensation benefits in case of injury or death.

NRC AGREEMENT STATE: No

WISCONSIN SOLID WASTE

TITLE:

Solid Waste Recycling Authority Act
Wisconsin Statutes, Chapter 305

PURPOSE:

To reduce environmental damage from solid waste disposal, and to coordinate solid waste processing in a manner to yield recoverable resources, and to assist local agencies in all matters of solid waste disposal and recycling.

DEFINITIONS:

1. Authority
2. Capital improvement
3. Collection
4. Energy balance
5. Municipal solid waste recycling facility
6. Municipality
7. Person
8. Recycling
9. Sewage and industrial waste sludge
10. Solid waste
11. Transfer station
12. Transportation

ADMINISTERING AUTHORITY:

Solid Waste Recycling Authority

AUTHORIZATIONS:

To coordinate all solid waste recycling activities;
To prepare plans and studies for solid waste processing sites;
To acquire, construct or operate solid waste recycling facilities;
To issue bonds and otherwise finance such facilities;
To undertake recycling research activities;
To issue regulations pursuant to the act;
To establish charges and fees for the use of facilities;
To require the use of authority facilities.

PROHIBITED ACTS:

To violate any provisions of the act or regulations;
To fail to use authority facilities when required.

EXEMPTIONS:

Authority facilities are exempt from municipal ordinances.
No required use of facilities for private persons and other non-municipalities.

WISCONSIN WASTE WATER

TITLE:

Pollution Discharge Elimination Law
Wisconsin Statutes, Chapter 74

PURPOSE:

To grant power necessary to maintain a state pollutant discharge elimination system, to eliminate pollutant discharges into water, and in other ways to comply with the federal water pollution control amendments of 1972.

DEFINITIONS:

1. Person
2. Municipality
3. Pollutant
4. Effluent limitation
5. Schedule of compliance
6. Discharge of pollutant
7. Toxic Pollutants
8. Point source
9. Biological monitoring
10. Discharge
11. Construction
12. Treatment work
13. Waters of the state
14. Department
15. Permit
16. Secretary
17. Owner or operator
18. Vessel
19. Pollution
10. New source

ADMINISTERING AUTHORITY:

Department of Natural Resources

AUTHORIZATIONS:

To issue permits for the discharge of pollutants into state waters;
To issue regulations and prescribe conditions for such permits;
To categorize water pollution point sources;
To establish effluent limitation standards for various pollutants;
To take other necessary actions to comply with federal pollution control guidelines.

CERTIFICATION OR LICENSING:

Permit required for the discharge of any pollutant into waters of the state or disposal of sludge from a treatment work.

PROHIBITED ACTS:

To discharge pollutants without proper permit;
To discharge in excess of limitation standards;
To fail to maintain records of discharges or to file new source reports.

EXEMPTIONS:

Department is allowed to exempt certain categories from permit requirements.

PENALTIES:

Normal violations--fine of up to $10,000;
Willful violation--fine up to $25,000 or 6 months imprisonment;
Subsequent offenses up to $50,000 and 1 year imprisonment;
False statement violation--fine up to $10,000 or 6 months imprisonment.

WISCONSIN WASTE WATER

TITLE:

Water, Ice, Sewage and Refuse Law
Wisconsin Statutes, Chapter 144.01-144.26

PURPOSE:

To grant necessary powers to protect, maintain and improve the quality and management of waters of the state, ground and surface, public and private; and to develop an action program toward these ends.

DEFINITIONS:

1. Waters of the state
2. Sewage
3. Waterworks or water system
4. Water supply
5. Sewage system
6. System or plant
7. Refuse
8. Owner
9. Industrial wastes
10. Other wastes
11. Pollution
12. Municipality
13. Nonprofit-sharing corporation
14. Department
15. Secretary

ADMINISTERING AUTHORITY:

Department of Natural Resources

AUTHORIZATIONS:

To survey and determine water conditions of the state;
To issue regulations pursuant to the act;
To inspect and investigate to ensure compliance with the law;
To establish certification requirements for waterworks and sewage treatment plant operators;

To administer financial assistance programs for pollution prevention facilities, potable water systems and sewage collection systems;
To assist in protecting state navigable waters;
To develop state water quality standards and take needed pollution abatement steps.

CERTIFICATION OR LICENSING:

Permits are required from county for septic tank installation.
Examination and certification of waterworks and sewage treatment plant operators is required.

PROHIBITED ACTS:

Sewage discharge from heavily populated areas or into periodic flood areas;
Sale of nondegradable detergents;
Actions which cause water pollution in violation of rules or regulations.

PENALTIES:

Fines of from $10 to $5,000.